The

Electrical Review

VOL. XCV. NOVEMBER 7, 1924. No. 2,450.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

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Telegraphic Address. "AGEEKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8360 and 8361.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

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Changed Atmosphere.

IT is recognised that in these pages we address ourselves to all who are interested in electrical and allied affairs whatever their political views may be.

For more than a decade now we have periodically devoted serious attention to the new and constantly changing problems that have arisen concerning industrial and trade affairs. At times these have become nigh overwhelming, and the question has been asked by many close observers, "Whither are we tending?" Those closely connected with the management, control, and development of industries have found the greater part of their time occupied with these matters to the exclusion of progressive enterprising endeavour. Only the most reactionary minds will suggest that the definitely decisive verdict of the electorate has disposed of all such questions as we have in mind. Many of them can legitimately claim, and will continue to receive, the deepest consideration, but it is clear beyond dispute that it is the will of the people that some of them shall be laid to rest. For years past we have been an unsettled and distracted people; every few weeks has brought some new disturbing factor into our common life with resultant uncertainty, nervousness, and anxiety crippling most of our efforts to re-establish trade and industry, to relieve them of their heavy burdens and encourage their free development, to build houses, and to find work here or in other parts of the Empire for the army of unemployed.

Only the deafest ears could fail to hear the sigh of relief at the emphatic way in which the nation last week expressed its determination that Britain shall stand at Home and abroad for strength, stability, order, and fair-dealing.

Limiting our consideration here mainly to the effect of the decision upon trade and industrial development,

we believe it to be the desire of the great majority of the nation that these shall be granted a period of respite in which to put forth unhampered effort for their own recovery and progress in the interests of all.

The extremists who have been permitted to exercise an influence far out of proportion to their importance have for some years designed to cripple private enterprise with a view to facilitating nationalisation or control. The effect has been a disinclination on the part of investors to put more capital into industry as long as there was fear that it would not have fair-play. This menace having been removed and fair-play being assured, so far as Parliament is concerned, there should be a freer flow of money into work-producing industry.

As one representative financial daily newspaper remarks in an editorial on the country's verdict: "With the guarantee of fair conditions, capital will now begin to function more freely, business men will become more venturesome, and the fight for trade will be resumed with greater vigour—all of them matters that have a very important bearing upon the great unemployment problem of the day."

Now that the country has by so large a majority placed authority in the hands of Mr. Baldwin, we may repeat a quotation already made here from his pre-election speech at the Queen's Hall. He said in the course of his references to electrical power and industry that the true function of government was to encourage in this country individual effort, to protect the consumer, to secure co-operation wherever possible, and to aid liberally scientific research whether by private individuals, by research societies, or by universities.

There is every reason to believe that the people have not been in the least influenced by the proposals recently advanced by the different party leaders for dealing with electricity supply. It may possibly be that in making up their minds how to vote they have been generally opposed to the extension of nationalisation and to interference with private rights and initiative, and in that way have expressed themselves regarding electrical policy. But so far as the Labour plan elaborated in the House of Commons speech by Mr. Snowden, and the Lloyd George "Coal and Power" pamphlet, are concerned, it is questionable whether, as direct factors, they influenced anybody. The technical committee set up by the Conservatives will doubtless continue its work, and in due course a policy will emerge, but it is certain not to be sensational.

The Dawes Scheme and "Reparations in Kind."

Last month the Grand Council of the Federation of British Industries decided to appoint a Special Committee to watch the working out of the London Agreement in connection with the Dawes Scheme, and to consider reports of difficulties received from Trade Associations arising from the operation of the scheme and especially from the "reparations in kind" clauses. The names of those who have been asked to serve on the Committee were announced in the organ of the Federation last week, and among them are the following:—Col. O. C. Armstrong; Mr. D. A. Bremner (British Engineers' Association); Mr. D. N. Dunlop (director of the British Electrical and Allied Manufacturers' Association); Sir William Larke; Col. R. K. Morcom; and Sir Peter Rylands. The proposals which emanated from Germany under which big electric power supply installations and railway electrification were to form part of the payments in kind, will be well remembered by our readers, as will also the storm of protest that the suggestions raised when it was suspected that they received support in certain quarters here. The strong protest forwarded to the Government of three years ago by the Council of the Institution of Electrical Engineers will be found in the Electrical Review for December 16th, 1921, p. 813. It drew attention to the crippling effect that such electrical reparations would have on our manufacturing concerns and the ruin that would overtake some branches of the industry. The need for the industry to present a solid front to the attack was dealt with in our leading article in that issue, and an important discussion on the subject by the Grand Council of the Federation was reported a few weeks later (Elec. Rev., January 20th, 1922). The members of the committee who have been elected to safeguard British electrical and engineering industries will have no uncertainty in their minds as to the views of the great interests that they represent.

Electricity at the Ideal Home Exhibition.

In March last we were compelled to comment adversely upon the poor show made by the electrical industry at the Ideal Home Exhibition, Olympia, an exhibition which above all others provides an opportunity of impressing upon the public the domestic virtues of electricity.

The Electrical Development Association was at that time doubtless putting all its efforts into the Wembley "Electricity in Service" display, and was thus too occupied to spare time for the smaller exhibition. Now, however, with the continuance of the British Empire Exhibition in the balance, the Association finds itself able to take a hand in next year's Ideal Home Exhibition. We therefore look forward to an interesting and instructive section devoted to electricity in the home, which, while not so big as the display at Wembley, will retain all the essential points which have made that section one of the most striking features of the Exhibition.

Upon the occasion mentioned above we also remarked upon the neglect of the opportunities which were provided by the model dwellings. We would suggest that the E.D.A. should get into communication with the builders of these houses to ensure that the superior claims of electricity are not overlooked upon the next occasion. It is "up to" the electrical industry to make certain that this time the Ideal Home Exhibition will not belie its name.

Charges for Electricity.

Under this head there are some interesting observations in the report of the Electricity Commissioners for the year 1923-24. In 36 cases in which maximum prices were revised, representing two-thirds of the total number of applications, the prices approved ranged from 10d. to 1s. per kWh, and in one instance 1s. 3d. was authorised. Eleven of the 37 cases related to local authorities, and 26 to companies, most of the small undertakings being in company hands. Commenting on this subject, the Commissioners say that the broad conclusion may be drawn that "for the proper operation of small undertakings under present-day conditions, a maximum price of from 10d. to 1s. per unit may be regarded as generally appropriate." It is well known that in villages and rural areas a supply of electricity for lighting at 1s. per kWh is heartily welcomed, and is well worth the price; it has been stated on high authority that twice that price would not be prohibitive. The demand in such cases is often mainly for lighting, necessitating a high charge in these days of "summer time" and highly efficient tungsten lamps, but obviously, if the standing charges are covered by the revenue for lighting, it will be possible as in other areas to charge a much lower price for other domestic uses, and for power where there is a demand for it.

With regard to the adoption of multi-part tariffs, it is somewhat singular that only two applications were made during the year for approval of such systems of charging. Great efforts were made to obtain relief from the obligation to offer an optional charge per kWh, and this was accomplished in the Act of 1922. Unfortunately, an acceptable basis for the fixed charge seems still to be lacking. In respect of a rateable-value

tariff which they were asked to approve, the Commissioners investigated the question and concluded that such a method of charging was not generally applicable to all classes of supply, and it could only be appropriate in areas possessing suitable characteristics; in the majority of cases, it must be accompanied by an optional "unit" system of charging.

A tariff consisting of a fixed charge per room wired plus a running charge per kWh was approved by the Commissioners early in 1923, but the two cases abovementioned, one involving rateable value and the other a charge per point, unfortunately were inconclusive, being complicated by special circumstances; however, it appears probable that in general the Commissioners would not approve of a compulsory rateable-value tariff for all classes of supply (other than power).

What, then, should be the basis of an acceptable two-part tariff? The subject was very fully discussed by the Institution of Electrical Engineers and the I.M.E.A. some years ago, and a deputation organised by E.D.A. pressed the matter on the attention of the Electricity Commissioners, who now have the desired power to dispense with the optional "unit" charge. It was always possible to adopt multi-part tariffs by agreement, provided that the option was given. Surely there is some way of utilising the extended powers of the Commissioners!

Gas and Electricity.

SPEAKING at the annual dinner of the British Commercial Gas Association recently, the new president, Mr. J. H. Ellis, chairman of the Plymouth Gas Co., commented on the competition between gas and electricity, and declared that there was plenty of room for both; their interests were the same. We welcome the tone of his remarks, which were in favour of collaboration between the two industries with the conservation of coal as their common aim. In his gasworks Mr. Ellis uses electricity freely, because of its cheapness (produced on site) and its adaptability; as an instance of the latter quality, he mentioned that electricity was employed to indicate at the works the pressure in the gas mains four or five miles away, so that it could be regulated. His view was that the gas industry secured the by-products of the carbonisation of coal and produced all the heat necessary to generate electricity: hence electricity works should go hand-in-hand with gas works, so that coal could be used to the best advantage.

Undoubtedly there are difficulties in the way, but the problem is one of immense importance, and a practical solution of it would be of the utmost benefit to the community. At the present stage, it would have to be approached along steam lines, for the gas engine cannot cope with the huge outputs demanded in these days, and the gas turbine is still in the early stages of evolution; but this fact, while it involves a lower thermal efficiency than is attainable with the gas engine, at any rate simplifies the problem, for there is no great difficulty in firing boilers with gas. Indeed, the electrical end of the gas-electric combination is already prepared to function, and we may point out that the use of pulverised fuel, which is gaining popularity, is a long step in the direction contemplated. It would seem, therefore, that we are waiting for the gas engineer to devise an economical method of producing gas suitable for heating boilers, whilst recovering the by-products as fully as possible. Perhaps this would involve the carbonisation of coal at a lower temperature than is customary in the manufacture of gas for public use, a process to which close attention has been given in recent years, and which has already attained to a moderate measure of success. The Fuel Research Board has put it in the front rank, and offers to test the proposals of inventors free of charge, subject to appropriate conditions. The conservation of coal is almost as important as the development of electricity supply, and this appears to be a hopeful avenue towards that goal.

Mr. W. B. Woodhouse, in his presidential address to the I.E.E., also referred to the subject of co-operation between suppliers of gas and electricity, in the public interest, and discussed the distillation of coal at some length, pointing out that the electrical engineer must regard it as within his province. But he expressed the view that no existing process was worthy of adoption.

Electricity Supply Progress in Italy.

AMONG the industrial groups in Italy which are faced with the largest capital requirements at the present time the electricity industry occupies the second place—the textile branches being first. During the first half of the current year, states a correspondent at Rome, 37 electricity companies increased their share capital by a total of 330,000,000 lire. Including new companies and deducting liquidations and reductions of capital, the net increase of capital in the six months in question amounted to nearly 353,000,000 lire. This movement is connected chiefly with a systematic development of all remunerative water powers that are available. At present the Società Adriatica di Elettricita, of Venice, is increasing its capital from 100,000,000 to 200,000,000 lire in order to provide means for the utilisation of the considerable forces of the Lake Santa Croce, in Friaul. The correspondent further states that the companies individually are getting into closer relations through their community of financial interests, and in this way not only is a more rational connection of the individual networks for the exchange of power rendered possible, but undercutting in the selling prices is being prevented.

The Electrical Trades Benevolent Institution.

THE annual festival dinner of the E.T.B.I. will take place on Wednesday, November 19th; Mr. Dane Sinclair will preside, and it is hoped that there will be a record attendance. In recent years the presence of ladies at the festival has been welcomed, and the function is a very enjoyable one, whilst those who take part in it have the added satisfaction of knowing that they are contributing to the success of a most worthy cause.

It has repeatedly been pointed out in our pages that whilst the electrical industry is constantly being rejuvenated by the continual inflow of new inventions and the development of new uses for electricity, thus enjoying perpetual youthfulness, those who have been engaged in it since the early days cannot share in this process of renewal; they must inevitably grow old and infirm, and lose the power of providing for themselves and their dependents. Moreover, sickness and accident may prematurely incapacitate the younger members of electrical staffs. Hence the warning has often been issued that before very long the demands upon the resources of the Institution would rapidly increase, and that in addition to giving temporary assistance it would soon become necessary to grant pensions, for which purpose a large capital sum must be provided. Our present purpose is to emphasise the fact that that is no longer a matter for the future; we have already arrived at that position. During the past year the Institution has been called upon for help to a much larger extent than in any previous year, and there is every reason to anticipate that each succeeding year will likewise set up a new record. Yet the interest on the invested capital is less than £1,000 a year—how many pensions can be afforded out of that small sum?

The electrical industry is always advancing, even when other branches of industry are depressed, and during the period of slackness in trade that we have been and are still passing through, our own industry has been comparatively prosperous. We have no compunction whatever, therefore, in appealing to our readers to give their cordial and material support to the Benevolent Institution, not only by attending the Festival Dinner, but also by forwarding donations to the funds, so that as new records of outgoings are set up, still handsomer records of income may be achieved. Every man who derives his living from an industry is a debtor to that industry; it is an individual responsibility which rests upon every one of us.

D

The Moderate-Powered Direct-Coupled Back-Geared Motor.

By E. G. ROSS, A.M.I.E.E.

WITH the ever-increasing use of the electric motor, the question of low-speed shafting, and its arrangements, is assuming some importance. The old arrangements of belt reductions, and the like, are open to severe criticism now, and it will be of interest to review the situation generally, as affording a means of appreciating the true commercial worth of the moderate-powered direct-coupled back-geared motor. Through the trend of economic circumstances these machines are destined to occupy an important place in the electrical industry. Their greatest sphere lies in the transmission of powers up to 60 h.p. or so, and it is regarding this that the present remarks are made.

Leather belt reductions are looked upon more or less as necessary evils. It is true that they are cheap to buy, but this is more than off-set by other points, including upkeep, which is very heavy. Before a belt reduction can function properly it is essential that the belt should be quite flexible and yet have a good gripping surface. This may obtain in a few factories, but does not obtain universally. A slight difference in temperature will make all the difference in the cling of any belt, and the higher the power transmitted the greater the change in cling with change of temperature. It is only now that this serious source of loss is being noticed. Apart from a change of efficiency in the drive due to this, the driven speed may vary quite appreciably. In the case of a pump drive, this fact, as much as any other, has led to the use of the direct-coupled motor or engine. Cases are well known where the volume or pressure of a pump (depending on its duty) has varied in a most irritating manner in a humid atmosphere, the trouble being ultimately traced to varying belt slip due to varying temperature. The continual doctoring of a belt with preparation is also an evil. As soon as a belt becomes slack, a large piece is cut out, and the already overstretched belt is stretched still further, the cumulative result being only too well known.

Then again, with the pulley and belt drive, it often happens that the pulley size is not properly reckoned with respect to the bearings of the driving unit. Time and again, the writer has had occasion to point out that pulleys specified to be fitted to motors are far too small in diameter. Many seem not to have the faintest notion that a motor or engine bearing may be overloaded very heavily by fitting too small a pulley to the shaft end. The result is that large numbers of motor or engine bearings are running under conditions under which they were not intended to be run, with the result that re-lining or re-bushing goes on continually.

Belts, properly looked after, will give satisfaction for a time, but, sooner or later, they must give out; especially since, as belt makers testify to be almost universal, they are *not* properly looked after.

For this reason, perhaps, the use of chains as driving agents is on the increase. These, however, are very expensive in first cost, and require special attention if they are to run satisfactorily. It is true that they represent a big advance on the leather belt, but nevertheless they cannot be said to be ideal in every respect. Inefficient arrangement is unfortunately, through ignorance, only too common, causing the ultimate failure of the chain. Also vertical drives must be specially designed, a point often overlooked. Special guarding arrangements have to be made, all of which increase the capital outlay. Dust and dirt are the greatest enemies of chains. Where the speed reduction is great, the efficiency of the chain is likely to decrease, although to nothing like the same extent as with a leather or cotton belt. In a long drive, besides taking up space, the weight of the chain alone may cause stresses on shafts and bearings which are not always allowed for, with trouble ensuing from that cause.

With the extension of modern costing systems it is now being proved up to the hilt that oncost reduction is one of the most important functions of management. It is also being demonstrated that a very important part of oncost is made up by millwrighting and repair charges. The fallacy of using out-of-date plant is slowly being laid bare, and people are realising that some means of reducing this part of the oncost are very necessary. Interest on capital outlay, as regards plant, is quite nominal usually, compared with the maintenance bill, and it is realised now that it pays to abolish, as far as possible, maintenance costs by introducing up-to-date methods of driving.

The natural result of this has been, primarily, to extend the use of the low-speed motor. This, however, has been shown to be not the best proposition for the purpose. It is expensive in first cost, and is very heavy in actual material weight. This has largely told against its use, as the ideal is to have a compact driving unit which may be comparatively easily set down, and coupled directly to the driven shaft. That this *is* the ideal is readily realised when due consideration is given to the very large number of mechanical speed reduction devices now being manufactured. These do not help matters much, as the units are invariably too heavy when mounted complete with the driving member.

The most satisfactory solution of the problem lies in the use of the direct-coupled geared motor. This machine consists of a standard type electric motor running at a speed between 800 and 1,200 r.p.m., and fitted with a simple spur reduction gear to bring down the speed to the required value on the second-motion shaft, which is fitted with a flexible coupling, the whole forming a simple, straightforward, compact, and reasonably light driving unit.

By its use, main belt reductions and their troubles are entirely eliminated. The driven speed is constant for any given load, and the speed variation with change of load and temperature can be kept within narrow limits. No attention need be paid to the machine beyond the usual oiling of bearings. The machine can be made reasonably foolproof, and unskilled labour may use it safely. The trouble of fixing pulley sizes is eliminated, and, as no pulleys are necessary, one cause of trouble with bearings is abolished. Even if the driven shaft be out of alignment, the flexible coupling looks after this, which is really a big advantage when considered from all points of view—especially the maker's, since he knows that the machine stands a fair chance of being reasonably treated.

The disadvantages of chain drives already mentioned are also eliminated, and their good points are incorporated in the use of the direct-coupled geared motor of moderate power output. Dirt and dust cannot harm the machine owing to its gears being enclosed. No difficulties in oiling can arise, as an efficient oil bath can be incorporated in the unit by a simple design of casing or guard. Vertical drives to horizontal spindles are obviated, together with their attendant special designing; where vertical shafts require to be driven, the geared unit can be quite easily arranged to suit the need. Long drives are also done away with, effecting a great saving of floor and wall space, and also the belt or chain guards insisted upon by the Factory Inspector.

The cost and weight of the low-speed motor are cut down very considerably by the use of the geared unit. For example, a 30-b.h.p., 300-r.p.m. semi-enclosed d.c. motor will cost £127 and weigh 27 cwt., as against a

geared unit having the motor running at 1,000 r.p.m. with a 3.3:1 reduction, costing approximately £74 and weighing about 13.5 cwt. It is also, obviously, more compact, the cubage of the low-speed machine being 60 cu. ft., as against 41 cu. ft. for the geared motor, which, being so compact, has thereby a great pull over the separate mechanical reduction gear mounted on a common bedplate with a driving agent.

The disadvantages of the geared motor are of a minor order, except, perhaps, as regards noise. They are, however, attendant on the older machines to some extent.

There are three main classes of geared motors, *viz.* :—

(1) The bracket type open-gear machine.
(2) The bedplate type enclosed-gear machine.
(3) The worm-gear (enclosed) machine.

With respect to price, they are set down in order of increasing cost, the worm-gear unit being as costly as a low-speed plain motor. This disadvantage has greatly offset its use. It has, however, one very good point in its favour, and that is its silent running. A good worm-gear can hardly be heard at all. However, as time goes on, improvements are being made in gears and gearing with respect to the reduction of noise, so conceivably we may some day be presented with an absolutely noiseless gear.

Noise, apart from magnetic hum, which is generally inherent in a motor, may arise in (1) and (2) above through

(*a*) The use of certain types of brackets and bedplates.
(*b*) Badly cut teeth.
(*c*) Bad alignment of wheels.
(*d*) Use of metal to metal wheels.
(*e*) Bad design of the spurwheel.
(*f*) Faulty design of guards.

(*a*) In a bracket machine, the countershaft bearings may be cast integral with the motor carcase, or may be in the form of a separate casting bolted thereto. In the latter case, noise is readily caused by the use of a cylindrical casting, which will resonate over a wide range of speeds. The bearings should preferably be joined by one solid bar of a shape suitable for the other mechanical conditions. This will obviate noise to a large extent. The box bedplate is a particularly bad offender in respect of noise, and as this is fairly universally used, it may be of interest to note that experiments were recently made to determine the best shape of bedplate to use in the construction of such machines. The results of these experiments favour the adoption of a simple bedplate consisting of a ∩-shaped casting, forming the four sides of a rectangle, the centre being left quite open except for a stiffening cross-bar. This generally runs quietly, although it is not absolutely noiseless. The sound emitted, however, is of low tone, and therefore not too noticeable or distressing.

(*b*) Badly cut teeth are not practically repairable. The only definite remedy for this is to procure new wheels with teeth correctly cut.

(*c*) Bad wheel alignment is often a cause of noise. A few thousandths of an inch in alignment make a world of difference in gear running. On this basis, all bearings and bearing housings should be carefully steady-pinned after final erection. These pins also ought only to fit in one position, so that, in the event of dismantling, the machine cannot be properly aligned again without using the steady pins. Long taper pins screwed on the small end to take a nut are the most satisfactory pins to use for this job.

(*d*) Metal-to-metal wheels are noisy, more or less, depending on the combination of metals used. Experience has shown the writer that the quietest running gear is the combination of paper pinion and cast-iron spur. Raw-hide pinions are not always quiet, especially when they distort, which they do fairly readily.

(*e*) The spur-wheel may be so designed that the section of the arm supporting the rim forms a natural resonator responding to notes of certain frequencies. The hollow channel section is particularly offensive in this respect, and the H-section arm only a little less so. The quietest running section appears to be oval in shape, but, unfortunately, strength considerations limit its application. There is room for some research here, since it is well-known that even the simplest of disk wheels are subject to "ringing," more or less, even at comparatively low speeds.

(*f*) Care must be taken in designing guards for the gears to ensure that they do not respond to a note set up by the wheel. This is, generally, easily arranged for in the design of the completed unit by allowing the motor carcase or bedplate to act as a shield for one side of the wheels, it remaining only to close in the periphery and other side by a suitable guard. A casting is best for this purpose.

Finally, a remark regarding maintenance: geared motors should have oil-ring bearings. Ball bearings or roller bearings as at present designed are not able to stand up to the vibration inherent in a gear drive. Even the best-aligned gear is not perfect, and will set up *some* vibration. Ball and roller bearings, therefore, should not be used, except in taking up a thrust. The plain oil-ring bearings need only be examined every few weeks if the machine is normally situated. Bearing caps of the permanently spring-hinged type are the best for the purpose of keeping the oil clean. Mere plug-in caps are of little use, as they are soon lost, with the inevitable result of the oil becoming sludged by dirt and dust.

The flexible coupling on the second-motion shaft end should preferably be of the chain or serrated spring type. Leather couplings or direct pin couplings are more or less noisy and troublesome to keep up, whereas the chain or spring coupling merely requires a small amount of grease inserted into the inside of the driving part once a year or so. The gears, if of the paper pinion type, need practically no attention. The faintest trace of good, pure vaseline, or clean grease, is all that is required to keep them in order, and this is simply applied.

Altogether, then, it will be seen that the direct-coupled geared motor has many advantages over other apparatus at present employed for the purpose of driving low-speed shafting, and manufacturers may in the near future, therefore, confidently expect an increasing business respecting this class of machine. This will be all the more welcome when it is considered how very simple the complete units are to make.

The Motor Liner "Lochkatrine."—The *Lochkatrine*, a twin-screw motor liner of about 9,500 gross tons, owned by the Royal Mail Steam Packet Co., left Belfast on October 16th after undergoing a general overhaul by Messrs. Harland and Wolff, Ltd. Electric light has been installed throughout the vessel, there being over 500 separate lights, in addition to 15 lamps each of 1,500 candle-power, for the working of cargo at night, and there is efficient ventilation, both natural and mechanical. There are four Diesel-driven generators, each having an output of 400 kilowatts. The deck and engine-room auxiliaries are all electrically driven, the total h.p. of the motors being over 1,300, of which the largest is 180 b.h.p., while wireless and submarine signalling apparatus has also been installed. The *Lochkatrine* is propelled by two sets of 8-cylinder Harland & Wolff-Burmeister and Wain Diesel engines. After undergoing very successful trials in Belfast Lough, the vessel proceeded to Rotterdam to take up her sailings in the Royal Mail Service.

Starting Polyphase Synchronous Motors.—In the October issue of the I.E.E. *Journal* Mr. E. V. Clark, B.Sc., A.M.I.E.E., states that while some difficulty may ordinarily be experienced in starting a polyphase synchronous motor simultaneously with the alternator supplying the circuit, the difficulty is greatly reduced if the alternator is of the asynchronous type; and that with small laboratory plant this method of starting is simple in the extreme. Further, if the asynchronous alternator has a wound rotor and an adjustable rheostat in its rotor circuit, then the synchronous motor may be run up to speed by the operation of the rotor rheostat, with the asynchronous alternator running at full speed throughout. A scheme for operating small synchronous motors in a factory with this method of starting is outlined as being technically feasible, though inferior to other methods in general convenience and, therefore, devoid of much commercial utility. Three fields where this method of starting may be of appreciable or occasional use are technical school laboratories, testing-shops of manufacturers, and for emergency use by supply authorities.

The French Electro-Farming Congress and Exhibition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

In France the extension of the applications of electricity to agriculture is proceeding along lines of strictly national development. For obvious reasons she does not wish to do business with or learn from Germany. Scandinavia is too remote, and for some reason apparently not quite in touch with France. To all other countries she can set an example, rather than expect to learn from them. In any case, the high Customs tariffs of France would keep out the actual electro-farming machinery of other countries.

Accordingly the Electro-Farming Congress and Exhibition which has just been held at Lyons was of special interest, as things could be heard and seen there that are peculiar to the electro-farming practice of that country.

As of course everyone is aware, one of the policies of France is to retain her agricultural population in the country. The reason for this is two-fold; first, there are not many persons out of work in the towns at present, but there would be if many gave up rural life for urban existence; secondly, as is the case with every other country, agriculture is the most important industry upon which the wealth of the nation ultimately depends.

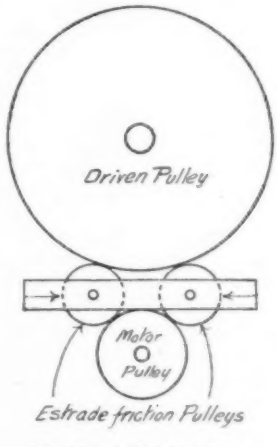
Some people are apt to think there is not a great deal in electro-farming. They may, however, be given "furiously to think" (to translate literally the French idiom) when they hear that over thirty papers were read on this one subject at this conference. Even then a big field is left for future conferences, as the main topic of the present congress was the economic side rather than the practical applications from the farmer's point of view. To put the matter bluntly, it seems to the writer that French engineers rather doubt the extent of their own knowledge when it comes to questions as to how best to apply electricity to agriculture. Still this is a trouble that arises in every country at present, for very few engineers have properly studied the farmer's side of the question. France would certainly seem to be one of the countries which would first overcome such a difficulty, for all the younger men, especially those who propose entering the Rural Engineering Service of France, are now taking a four-year college course, consisting of two years in electrical engineering and then two years in agriculture. Such a man when qualified is called an "Ingénieur Agronome Electricien," which might be translated as "Electro-Farming Engineer." The "Ingénieur Agronome" has been in existence in France for many years. It is to be feared that in England there are very few properly trained agricultural engineers, not to mention electro-farming engineers. However, the signs of the times are that this matter will soon be remedied.

The Congress and Exhibition were held in the magnificent ferro-concrete buildings constructed for the annual Lyons International Manufacturers' Fair, which is held each spring. (This fair dates back to 1419.) By far the major portion of those attending the rural electrification meetings were obviously the engineering element rather than the farming side. In fact the whole affair was rather too electrotechnical for the ordinary farmer. Further, the exhibits were of a similar nature. As a matter of fact, the farmer would learn much more by a visit to the annual agricultural machinery exhibition which is held at Paris in January.

The importance with which the congress is esteemed in France may be judged by the fact that the French Premier visited it, and the respective Ministers of Agriculture and Public Works presided at the opening and closing ceremonies.

The predominating note of the papers was that of economics. It was very clearly brought out that though electrical laws had to be observed equally in the country as in the town, yet there was a distinct difference in the rural problem. That main difference was the dual one of rural distribution and of actual application on the farms. It is not easy to construct satisfactory and yet economical distribution systems. Hitherto economy of construction has not had to be very seriously considered in urban areas, as the density of the population is always considerable. In the country, with its sparsely distributed population, this matter is of course all-important, and therefore must be studied most carefully.

Quite a number of the papers dealt with official rules and regulations; the desirability of modifying these; and the different forms of encouragement offered by the State, the Departments, and the communes. While the French regulations are very much more favourable to electrical enterprise than are the British, it is interesting to note that French engineers think there is a lot of room for improvement in their own regulations. It might do them good to know with what the British engineer has to contend. Distribution by extra-high-pressure lines was also considered. Hitherto it has been assumed that such lines existed merely to convey power from an economically situated generating station to a crowded centre of consumption. The rural load is, however, necessarily going to modify this conception.



The Estrade Driving Gear.

Wiring rules for rural conditions were discussed. In many cases, such as cow byres, &c., the conditions on a farm are more severe than in an ordinary town. Further, there is a greater fire risk owing to the large amount of combustible material about, such as straw, hay, &c. External mains were advocated for all the distributors on farm buildings. Heights of bare mains were specified, so as to clear loads of hay, &c.

The subject of tariffs was brought forward, and as is the case in any other country, this gave rise to a very hot discussion, made more interesting in this instance by the excitability and oratorical powers of the native speakers. Needless to say, the question was not finally settled.

Some interesting particulars were given as to actual consumptions of electricity in rural areas—information for which many engineers are now looking.

On the technical side, papers were given dealing with the specifications of rural networks; the conductors; the supports for the lines; the transformers, with special

reference to iron losses. A paper dealing with the rival merits of 115/200 volts versus 230/400 volts (on a three-phase system), as the standard for low-pressure supply, aroused considerable discussion. By the way, the French standards seem likely to be more in accord with British ideas than those of the rest of the Continent, which seems to have settled down to a 220/380-volt system. No mention was made of the possibilities of single-phase distribution. Three-phase was apparently taken for granted.

There were only three papers dealing with practical applications. These were electric ploughing; electroculture; electric heat storage and electric traction with storage accumulators. In the paper on electric ploughing, the principal French types were described, together with notes on the results of operation. An interesting fact elicited was that on French farms in the Oise district the consumption of electricity was 5 kWh per acre for thrashing; 3½ kWh per acre for general farm purposes; and 16½ kWh per acre for ploughing. Notwithstanding the heavy rains this year, the electric ploughs did their work well, thus proving one of their advantages in being able to cope with bad weather.

In the paper on electroculture, reference was made to British work. Of recent years this class of work has been carried out in France by Dr. Heim. While the results seem to portend well for the future, it was felt that the matter was still in the experimental stage.

As regards electric heat storage, reference was made to the developments in Scandinavia, Switzerland, Italy, the Pyrenees, and the French Alps. A good deal of heating of rooms, of bakers' ovens, of cooking stoves, and of boilers is now being carried out electrically in this indirect manner, whereby heat is stored in off-peak hours for use when required.

A very interesting feature of many of the papers was that they concluded with a definite resolution which was submitted to the vote of the Congress. This idea will undoubtedly make the work of the Congress of some definite value. It is the fault of many conferences that notwithstanding the indirect good they do to individuals as a body, they generally end in pious hopes.

The exhibition proper was a little disappointing in that on the whole it catered more for the engineer in charge of the construction of overhead lines than for the farmer. An indirect compliment (not acknowledged of course) was paid to the British Electrical Development Association in that a model farm exhibit was shown, arranged on similar lines to the one at Wembley —even to detailed tables as to what a unit of electricity would do on the farm. Of course the machinery was all French (with the exception of a couple of English barn machines). Fortunately more space was available than at Wembley, which gave an opportunity for a better display. Countershafting drives were a little too prominent in this exhibit, considering that farmers in the countries where more experience has been obtained are giving them up.

A considerable number of portable motors mounted on wheeled trucks were shown by various exhibitors. These were generally equipped with a countershaft. In some cases gear reductions were used; in others, belts; while a novel reduction gear was one of the friction disk type. Again, these portable trucks can only be classed as a passing phase in the light of experience.

In contrast with the above-mentioned somewhat out-of-date features, there was a very interesting exhibit that is far ahead in modern electro-farming practice, and that was the Estrade driving gear for small farm machines. This scheme permits of an electric motor being simply placed in a cradle on any machine that it is desired to drive. Then by means of ingenious intermediate double friction pulleys, the drive and speed reduction are effected. The motor can be left permanently attached to a machine, or if it is desired to economise in capital, it can be easily moved from machine to machine, since it can readily be detached by slackening a hand-tight screw. The motor cradle is so fixed that there is a gap of a couple of inches between the metal motor pulley and the metal pulley of the machine to be driven. Into this gap a special rectangular steel frame is placed, which contains two pulleys made of pressed fibre (or similar material). These two pulleys are pressed toward the centre of the frame by springs. To put the frame in position the friction pulleys are held apart by hand. On releasing the pulleys, each comes in contact with both the motor pulley and the pulley of the machine to be driven, thus effecting the drive.

A number of transformers of somewhat indifferent construction (except one) were on view. Also a number of typical modern French transformer towers for small rural loads averaging up to 50 kVA were shown. French practice in this direction seems to be settling down to a form of sheet-steel sentry box for the transformer and switchgear, on the ground level. The corners of the housing are then carried up by braced angle irons to the required height for the insulator arms. Square-mesh wire netting is employed to protect the descending bare live wires within the angle-iron construction. This practice would seem quite sound in every way, except that of first cost, which is bound to be on the high side.

A number of patterns of concrete and angle-iron base supports for wooden poles were exhibited. By means of these permanent supports, the pole bottoms are held above the ground line. Hence the trouble of rotting of poles at the points where they enter the ground is eliminated. Neither is it necessary to creosote them.

Some interesting electrically-operated woodworking machinery, constructed entirely of wood, was on view. A small saw bench constructed in this manner was priced at £4, whereas in iron it would have sold for about £10. In order to get machines into as wide a use as possible on farms, it is valuable to have them available at a low capital cost. A farm is not like a factory: all its work is seasonal, hence there is a limit to the capital that can be locked up in any particular machine.

French switchgear, on the whole, seems to be flimsy and unsuitable for agricultural work, judging from the exhibits displayed.

(To be continued.)

High-voltage Impregnated Paper Cables.—In order to overcome the limitation of carrying capacity of high-voltage cables imposed by high dielectric losses, science has had to be called upon to introduce measurements and tests to control this quantity. The exact experience gained in the development of such tests in co-operation with practical experience enabled the industry to attack the next limitation that confronted it, namely, dielectric strength, and the present problem is the complete elimination of occluded air and vapour from the insulation. Air films have been regarded as causes of low dielectric strength, due to ionisation of the air and consequent formation of hot spots, but Messrs. W. A. Del Mar and C. F. Hanson advance a theory in the August issue of the A.I.E.E. *Journal* that a more useful conception of the danger of air films is that they promote internal surface leakage. It has also been generally believed that air films can be detected by the slope of the voltage power-factor characteristic, but the authors, who are both of the Habirshaw Electric Cable Co., contend that such is not the case. It is pointed out that the foundation for future developments has been laid by the equipment and organisation of American cable manufacturing plant for accurate quality control by the continual testing of raw and process materials.

Lightning.—According to Mr. F. W. Peek, Junr., consulting engineer at the Pittsfield works of the General Electric Co. of America, who bases his conclusions upon results obtained in the high-voltage laboratory, lightning does not always strike the highest point unless it is over 2.5 per cent. of the cloud height above ground. An object 1.1 per cent. of the cloud height would be struck 50 per cent. of the time; thus, a man standing directly under a cloud 1,000 ft. above the ground would be struck 15 times in 100 strokes, and a man flat on the ground only once in a hundred strokes. Similarly, a 25-ft. building would be struck every time. Surrounding a lightning rod there is a protected area with a radius four times the length of the rod. A lightning flash may be of several million horse-power, with voltage of about 100,000,000, while the current is about 80,000 amperes, and the energy 3.6 kilowatt-hours. One or 2 per cent. of the lightning voltage and two hundredths per cent. of the energy may be transferred through space to a transmission line several thousand feet from the flash. The insulation of 220,000-volt transmission lines is sufficient to make them almost free from lightning trouble.

Technical Photography.

THERE is much virtue in a good photograph of a machine or other engineering product. The next best thing to seeing the thing itself is to see a truthful picture of it; and there is nothing more convincing or informative than a photographic illustration. But not every photograph serves its purpose efficiently. We have had abundant evidence of this fact in our long experience, and a few suggestions to our readers may not come amiss; there is nothing in them beyond what we venture to call practical commonsense.

In the first place, works photographs are usually taken indoors, and there the conditions are very different from those obtaining in the open air; moreover, the methods adopted in portraiture are unsuitable. Frequently the space available is restricted, necessitating the use of a wide-angle lens, which should have a deep focus, and whereas in portraiture it is preferable to obtain soft outlines, in photographing machinery very sharp focusing is necessary. A small stop should be used to increase the depth of focus, and due allowance should be made in the time of exposure for the resulting loss of light, as well as for the low intensity of illumination prevailing indoors. The illumination of the darker recesses of the subject should be taken into consideration, and the colour of the surface is an important factor; often black or dark grey is used, and both of these are unfavourable to photographic reproduction.

Turning from the process to the subject, very much depends upon the presentation of the latter to the camera. It is remarkable how many photographs come to our hands in which this consideration appears to have been neglected. Often the machine stands upon rough planks, untidily arranged, with packing cases, tarpaulins, &c., disfiguring the view. Behind the subject may be seen a row of coats on hooks, or other irrelevant and undesirable objects; amongst these must be included parts of other machines in the background, which often appear to belong to the subject of the photograph. Sometimes an artificial background is erected, consisting of canvas or paper, but in many cases the remedy is worse than the disease, every wrinkle or crease being faithfully reproduced and giving an air of untidiness, which is very detrimental to the result. Great care should be taken to provide a smooth and flawless background of neutral tint. It is true that such defects as those mentioned above can be removed by retouching; but that is an expensive process, and needs technical supervision, to guard against error, and it is better to obtain the best result possible in the first instance.

Correct illumination is important, but cannot always be provided; the chief source of light should be situated approximately above the left shoulder of the photographer when focusing. Windows and white surfaces behind the subject greatly detract from the effectiveness of the photograph: if a print showing such white patches is examined, when the patches are covered with dark-coloured paper it will be observed that the details immediately become clarified and the subject stands out more boldly. The white patches, in fact, have the effect of "glare" upon the eye and thus reduce the visibility of the subject. When reflecting surfaces are present, as in the case of a polished slate switchboard, the photograph may be completely spoilt; sometimes the photographer and his camera appear portrayed upon the print, and windows in front of the subject are superposed upon it with disastrous results, whilst the switches, &c., appear in conjunction with their own images, hopelessly confusing the picture. Windows can be obscured, but the other reflections referred to can only be avoided or minimised by careful selection of the point of view.

When the photograph embraces a number of machines, the interior of an engine room, or other subject to which the natural background is an essential adjunct, the composition of the view becomes important. A heavy horizontal shadow in the distance carrying on the appearance of a moulding on the subject, or falling flush with a flat top, may ruin an otherwise satisfactory view, and similar coincidences or illusory effects may result from a variety of causes, though by a slight change in the point of view they would be avoided. On the other hand, changes may fruitfully be made in the scene itself; for instance, a blank wall at the end of an engine room may be partly filled up by running the overhead travelling crane down towards that end of the room. It is a mistake, too, to arrange the view so that a large unbroken expanse of roof or flooring appears in the foreground. Preferably, living beings should be excluded from the view, as few of them can stand motionless during a long exposure. Men may walk about freely in the distance, as their images will not appear on the negative, but they must not stand still within the field of view. When they form an essential part of the scene, the exposure should be shortened, at the sacrifice of detail and sharpness of focusing.

Photographs by incandescent lamplight require a protracted exposure; the lamps should be carefully shielded from view at the lens of the camera. Arc-light photographs are more satisfactory. When flashlight is indispensable, it is advisable to use several flashes from different points, out of the field of view, to prevent heavy sharp-edged shadows; these flashes may be consecutive.

When the negative has been developed and fixed, a remarkable improvement in contrast of light and shade and visibility of detail can often be effected by intensifying it by one of the usual methods. This applies especially to weak negatives. Sometimes the result may be compared with the outbreak of sunshine on a gloomy landscape.

Lastly, when the print has been made and toned, further improvement may be effected by trimming it. This is of considerable importance, especially if the print is to be used for reproduction in pamphlets or in the Press. Very often there is far more on the print than is required, and two results follow: attention is diverted from the true subject by the superfluous items in its neighbourhood, and the proportion of space occupied by the principal subject is so much the less when the engraving is made. All superfluities should be trimmed off, leaving a suitable but not too wide margin, and having regard to the balance of the picture. If for this purpose, or in order to reduce excessive floor area, it is necessary to cut away part of the pedestal or bedplate of a machine, it may be preferable to do that rather than to spoil the picture by the other defect.

A common error in retouching is to block out the whole of the background on the negative itself, so that the switchboard, turbo-generator, or what-not is seen floating in space. This is utterly unnatural, and what is unnatural is neither artistic nor efficient. If the background is blocked out, a piece of flooring should be drawn or brushed in, upon which the subject appears to stand. One's natural instincts are thus satisfied, gravitation is provided for, and one does not feel repelled by an abnormality which tends to destroy reality.

Metallic Resistance Materials.—A revision of the British Standard Specification for metallic resistance materials for electrical purposes, first issued in 1921, has just been published. The sizes of wire included in the first issue had been criticised in some quarters, and these were reviewed, but evidence was given that the sizes were coming more into general use, and the conclusion reached by the Committee was that it was inadvisable to make any considerable modifications to the list at the present time. The only important changes are the addition of a smaller size of wire, namely, 0.002-in. diameter, and a schedule of thicknesses of silk and cotton-covered wire, based on general practice, has been included in an appendix for the convenience of users; the other changes in the specification are of a minor character. Copies of the publication (No. 115-1924) may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1. Price, 1s. 2d. post free.

The Position of the Electrical Industry in Austria.

(By a Vienna Correspondent.)

THE prospects of the electrical industries here, after the lengthy strikes, are not very promising. The number of unemployed is still considerable.

The Home business of the electrical industries suffers from the fact that at present, owing to the great financial stagnation, it is impossible to entertain new investments, and on account of this mass manufacture, particularly in the case of the manufacture of electric motors, is impracticable. Orders in hand at present relate chiefly to electrifying works and the construction of hydro-electric power houses. These are only temporary, and are now nearing completion, while the extension of the electrification programme, in consequence of the even more difficult credit conditions, seems quite hopeless. On account of the Home orders, the electrotechnical manufactories are obliged to keep a relatively large staff of workmen, without having the regular serial manufacture, and consequently out of the large number of workmen, one part is sometimes overcharged with work, according to its character, while the other part is, so to say, without work. Until recently the foreign business was more favourable—50-60 per cent. of the electrotechnical products of Austria were exported, and chiefly to the new Succession States and into the Balkans in general. German competition is an important factor to be reckoned with. Some of the big Austrian electrical concerns are able to export, notwithstanding unfavourable producing conditions, through territorial contracts with the German sister firms. That the conditions of production are worse in Austria than they are in Germany could be shown numerically by those firms who have works in Germany and Austria as well, and who manufacture the same articles in both places. This disadvantage, of having to contend with higher costs of production, existed before the war in Austria, and in recent years the difference has become still greater on account of the big socio-political burdens, the excessive taxes, and the shorter working hours in the factories. By reason of the latest advance in wages the prospects of export possibilities and the competitive power of the Austrian electrotechnical industry are becoming illusory. Calculations that were made recently have revealed the fact that the anticipated reduction of the taxes and the cheapening of the bank rates and the reduction of other burdens will not be sufficient to counteract the excess of production expenses, involved through the rise in wages; but, at any rate, they will give a fresh impetus to exportation enterprise. Another factor which is expected to promote export is the great increase of works for manufacturing wireless apparatus and accessories. These are not new enterprises, but the transformation of clock, gramophone, and other factories for the manufacture of wireless sets. The number of such works is considerable, and although the home demand is an immense one, there is still ample production for exporting, and as there is a very great interest shown by transatlantic peoples in wireless affairs, it is hoped that South America will absorb a great quantity of Austrian wireless goods.

With reference to the position and prospects of electrifying the Alpine railways, the electrification of the Arlberg route is advancing by leaps and bounds. The main line connects Paris with Vienna, through the Swiss and Austrian Alps. In the past few weeks trial trips on the Landeck-Sankt Anton have been made, and if no considerable delays occur in the continuation of the work, the whole Landeck-Bludenz route will be electrified by the middle of 1925, because the construction of the Spuller See Works is so advanced that at the beginning of next year the trial works will be begun. The continuation of the electrification westwards to Feldkirch-Buchs (Swiss frontier) and toward Bregenz depends entirely upon the completion of the Spuller See works. It is hoped that the electrification of this route running westwards from Innsbruck will be accomplished by the end of 1926. The Swiss Federation is also contemplating the electrification of the Zurich-Sargans-Buchs line, to be ready in the course of 1926. The line from Zurich to Innsbruck, and eventually also farther down, will be electric. Considering the very great number of long tunnels on this line, the convenience of dispensing with steam locomotives and their smoke is self-evident.

Besides the foregoing, further lines to be electrified are: Innsbruck-Brenner, Innsbruck-Wörgl-Kufstein and Wörgl-Saalfelden; these works are intimately connected with the Achen Lake power station, being built by the Tyrol Electric Works, which will supply the current for these lines. The Achen Lake station will be ready by the end of 1927, and by that time the electrification of these lines will be completed. Another line to be electrified is the Semmering line, traversing the most picturesque region in the vicinity of Vienna. The terminal station of this line will be at Graz. The plans and projects for this great work are already finished. The final decision depends upon the price of electricity supplied by the "Steweag" Company in relation to the coal prices, and also upon the price of money, for it is much more difficult for the Austrian company to work with dear money than for the Swiss companies that pay 5-5½ per cent. interest on loans.

Low- *v.* High-Temperature Valves for Wireless Reception.

By ALAN L. M. DOUGLAS, M.I.R.E.

THERE is at present still considerable controversy regarding the merits and demerits of dull-emitter valves as compared with the ordinary type of bright-burning valve. It is interesting to examine briefly the characteristics of the different types, and to compare the points in which they differ.

In the ordinary bright-burning valve, the emission from the filament is directly dependent on the temperature of the latter. Continual heating of the wire attenuates it, with the result that the filament gradually becomes brittle, and unless it has some reasonable thickness, will break. So the filament of a high-temperature valve must be robust, which necessitates a considerable amount of current to heat it to give the required emissivity. It is obvious, therefore, that filament control will have a marked influence on the behaviour of the valve, and will, indeed, become one of the important adjustments in a receiver employing bright-burning valves. Consider now, however, the question of constancy of action. If the emission is entirely dependent on the temperature of the filament, it is evident that it will be constant at all times, provided that the temperature is maintained constant. Therefore the valve will always function in a regular and dependable manner, and furthermore, as the electron stream will be constant (provided that the source of heating current is not interrupted), the value of the current in the telephone circuit will remain constant, and the valve may be called silent in action.

It is obvious also that a valve with a comparatively heavy filament will withstand a considerable amount of abuse, and furthermore that the filament will not be attracted to the anode as the result of varying space charge intensity to any great extent. The large diameter wire will give a very heavy flow of electrons, and the valve may be made to carry and handle quite large currents with ease.

Turning now to the dull-emitter or low-temperature valve, in this type the emissive qualities of the filament are increased very considerably by coating it with some compound which radiates actively when raised to a low temperature only. There are a number of such substances available, but nearly all possess the

disadvantage that they are liable to be intermittent in action or that their activity varies very greatly with their age. It has been found that thorium is the most reliable base to adopt as a coating material, and so this metal is employed either in the form of a salt (in which state it is applied as a coating to a thin tungsten filament) or as an ingredient of an alloy of which the filament is completely made. The latter construction is generally preferable, as being much less likely to function irregularly, but patent and other considerations prevent its universal adoption. The fact that these thoriated compounds radiate actively at low temperatures means that only a very small amount of heating current need be applied, which in turn means that an exceedingly thin filament can be used.

This, of course, increases the elasticity of the filament, and decreases the control which the grid can exercise, at the same time making the valve much more sensitive to mechanical vibration. The net result of all this is to make the valve very "microphonic," *i.e.*, liable to make ringing noises with the slightest displacement of the filament. This is a defect common to all dull-emitting valves, and frequently even persons speaking in the same room as the valves will cause objectionable sounds in the signals.

On account of the small amount of heating current necessary to obtain the required emission, usually only a matter of milliamperes, filament current control is not of importance, and the adjustment is consequently not used unless it be necessary to reduce the pressure from, say, 4 volts to 2.5 volts, or whatever the correct working voltage may be. The degree of emission is probably not quite so great as that obtainable from a high-temperature tungsten filament, but is quite considerable, and in some modern designs, employing very long filaments, is sufficient to operate power amplifiers.

Owing to the alloy or other means of thoriating the wire, under the continual stress of the varying space charge, the filament may tend to partially disintegrate. This causes noises in the receiving apparatus, and is another of the disadvantages of the dull-burning filament. Against these must be set the considerably increased life of the low-temperature filament and, obviously, the great economy of operation. The latter feature is probably the most attractive point in favour of the dull-emitter, for it is hard to see any others.

Of course, the anode may be brought near to the filament in the case of a low-temperature valve, thus decreasing the internal resistance and so permitting a lower value of h.p. battery to be used. This is, indeed, a rather desirable feature of the dull-burning filament, as it decreases the electrostatic attraction between filament and anode, and so serves to prevent rapid disturbance of the chemical constitution of the former.

The reader will therefore deduce that there are few occasions where either bright or dull-emitting valves may not be freely interchanged at will, and in conclusion I should like to point out that in spite of many statements to the contrary, there is no substantial reason why dull-emitting valves should not be used for reflex or dual-amplification circuits. Care must, of course, be taken that the filament temperature is not allowed to rise above the maximum specified by the makers, otherwise the thoriated coating may be burnt off and the valve become useless.

French Rural Electrification Loans.—A law was passed in France in August, 1923, placing at the disposal of the Office National du Credit Agricole a sum of 600,000,000 fr. to be distributed in the form of long term loans to be granted at reduced rates of interest to communities for rural electrification. At the recent Rural Electrification Congress held at Lyons, it was stated that the law in question was a snare since the subsidies proposed were only possible if the necessary credits were incorporated in the budget estimates. But no such credits were provided for and the State finances were unfavourable.

Legal.

Metropolitan-Vickers Electrical Co., Ltd., v. British Thomson-Houston Co., Ltd.

THIS case, which was held over from last session, again came before Mr. Justice P. O. Lawrence, in the Chancery Division, on October 28th. The plaintiffs claim infringement of their Patent No. 9,644 of 1912, for an invention of "Improvements relating to synchronous dynamo-electric machines." The earlier stages of the case were reported in our issues of July 18th and 25th, and August 1st and 8th.

After Sir DUNCAN KERLY, K.C., had addressed the Court on behalf of the plaintiffs, his LORDSHIP reserved his judgment.

The Dismissal of an Employé.

IN the Mayor's and City of London Court, before Judge Shewell Cooper, on October 28th, an ex-service man sued Messrs. R. Lehmann & Co., manufacturing electrical engineers, Peninsular House, Monument Street, E.C., for £16 16s. 7d. for salary due in lieu of notice. For the plaintiff it was stated that he entered the employment of the defendants in July, 1924, as a transformer designer, and on August 8th was given a month's notice. Plaintiff stated in evidence that he was trained under the Government scheme for a period of three years, and went to the defendants after six months in a firm of transformer designers and contractors, with an excellent reference. The defence was that the plaintiff obtained the situation by false representation in declaring that he had a thorough works training with a large firm in the North of England, whereas in fact he had not. Inquiries were made which showed that other statements made by the plaintiff were not true and a letter was written to him while he was on holiday summarily dismissing him. Judge SHEWELL COOPER said an employer was entitled to summarily dismiss a servant if he was found to be incompetent, but the degree of incompetency had to be very high. In the present case he thought that while the plaintiff was not fully competent to do the work required he was not so grossly incompetent as to warrant summary dismissal, and he gave judgment for the plaintiff with costs.

Wilderman v. F. W. Berk & Co., Ltd.

ON October 30th, before Mr. Justice Tomlin, in the Chancery Division, the plaintiff, who stated that he was a Rumanian subject, claimed relief in respect of the alleged infringement of letters patent No. 26,568 of 1910, granted to him for an invention of "Electrolytic Cells for the Electrolysis of Alkaline Salts." For the plaintiff it was stated that, in 1919, the defendants had imported caustic potash produced by a German firm by a method similar to that covered by the above-mentioned patent. This, it was claimed, constituted an infringement of the patent, and the plaintiff asked for damages and an injunction to restrain further infringement. In reply, the defendants stated that:—(1) Importation did not constitute infringement; (2) the plaintiff was at all material times residing or carrying on business in Germany, and, therefore, could not sue; (3) at the date of the alleged infringement the patent was vested in the Custodian for England and Wales under the Trading with the Enemy Amendment Acts; and (4) the defendants were not aware of the plaintiff's patent and acted innocently.

His Lordship dismissed the action with costs, agreeing with all the points of defence.

Fraudulent Consumption of Electricity.

A FINE of £5 was imposed on a Liverpool electrical worker at the Liverpool Police Court on October 30th, for wrongfully consuming electricity from the Corporation mains to the value of 1s. A cable was led from the main distributor to an upper room and current was used, without passing through the meter, for charging accumulators.

Ebonite Dealers and Trade Information.

IN the Chancery Division on October 31st, Mr. Justice Astbury tried an action by Frederik Wilhelm Lowenadler, merchant in ebonite goods, against Albert Lee, a director and manager of Radio Ebonite Supplies, Ltd., dealers in ebonite goods, and also against the company.

Mr. ARCHER, K.C., for the plaintiff, said the action was to restrain the defendants from making use of information wrongfully obtained by one of the plaintiff's employés and wrongfully conveyed to the defendants. It was alleged that Mr. Lee induced the employé to commit a breach of contract, but that was not relied on now, and all that the plaintiff wanted to make sure of was that the information was not conveyed to others. The defendants denied that they induced the employé in question to supply, as was alleged, any list of the plaintiff's customers.

Giving evidence, Mrs. WATSON (*née* Butler), formerly employed by plaintiff, said that she sent to Mr. Lee three lists of names of people with whom Mr. Lowenadler could not deal. There were about 20 names and eight more were given to Mr.

Lee on the telephone. She did not at any time take the names from a book, and she never intended to hurt Mr. Lowenadler in any way.

Mr. LEE, the defendant, said he often had discussions with Mr. Lowenadler as to prices of ebonite, and at times Miss Butler was present. He had not at any time made use of the information given by Miss Butler. Miss Butler also sent a list of names which she thought would be of interest to him. He glanced at the list which she sent, but he did not remember any of the names, and the list was destroyed.

His LORDSHIP, giving judgment, held that Mr. Lee induced Miss Butler to act as she did, and he was satisfied that she gave him a number of names and addresses of customers who were actual buying customers and not mere inquirers for the cheap ebonite of the plaintiff. His Lordship said he would grant an injunction restraining the defendants from making any use of any information as to the plaintiff's customers obtained by Mr. Lee from Miss Butler. Plaintiff did not ask for damages although he would have been entitled to nominal damages for the wrong that had been done to him. The defendant must pay the costs of the action.

Dublin Electrician's Compensation Claim.

BEFORE Mr. Justice Dromgoole, in the Dublin Circuit Court, recently, Mr. Sean McGarry, electrical engineer, St. Andrew Street, Dublin, was awarded £2,477 as compensation for malicious injury to stock-in-trade, fittings, fixtures, and furniture.

It was explained that Mr. McGarry had strongly supported the Anglo-Irish Treaty, and was later a commissioned officer in the National Army. He had a large stock at his premises when, in February, 1923, a land mine was placed on the premises by opponents of the Free State. The mine exploded and destroyed the stock and fittings, wrecking the whole interior of the establishment. Six weeks previous to this outrage his private residence was set on fire, his wife was severely burned and his son, a child, was so badly burned that he died.

Brandes, Ltd., v. Super Radio Co.

MESSRS. SUPERADIO, LTD., Old Street, E.C.2, ask us to state that the defendants in this case (reported in our last issue) have no connection with them, or with their sister company, Superlamp, Ltd.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cable Network Losses.

Referring to the question raised by "Ignoramus" anent cable network losses, expressed as a percentage of the "units sent out," perhaps one may be forgiven if one calls the attention of "Ignoramus" to the fact that he has said nothing whatever respecting the condition of his network, neither has he mentioned the bus-bar pressure necessary in order to keep the declared pressure within the limits prescribed. Is one to assume that "Ignoramus" is experiencing exceptionally heavy losses which he is incapable of accounting for?

Osmose.

October 27th, 1924.

Regulations.

If I were merely an outsider and not a colleague in municipal electricity supply of my good friend and neighbour, Mr. Robinson, I should have said that, judging by his latest outburst, the engineer at Hackney must have lost all sense of reason and proportion.

First, let me remind Mr. Robinson that he was a member of the I.E.E. Wiring Rules Committee, until his automatic retirement from the I.M.E.A. Council. May I further remind Mr. Robinson that the I.M.E.A. has, on several occasions, strongly supported proposals, not only in regard to the regulations about which he is so cross, but has pressed for their compulsory enforcement.

Mr. Robinson's letter is a long diatribe about matters in general but nothing in particular; he does not point to one regulation which will bring about the downfall of that "City Electra" behind which he has entrenched himself.

Can Mr. Robinson state exactly what difference there will be in price by making a good installation under I.E.E. regulations and otherwise? Even if it costs a little more, as electricity is the only thing to be considered in our lifetime, we want an installation to last our lifetime, and with all the wonderful advantages of "Hackney Electricity," the initial cost must surely be of no importance.

On Mr. Robinson's principle, he would not think of using anything but a "Ford" or "Trojan" for motoring purposes—but I forgot, a "wind-jammer" is his recreation.

But really if Mr. Robinson has the welfare of the industry so much at heart, why has he so rushed into print—why has he not approached the I.M.E.A. and the Wiring Rules Committee, and laid his objections before them in detail? It would have been of far greater assistance to the industry whose "enormous progress" he is so proud of, instead of publicly damaging and defying the work of a large committee representing the "supply engineer, contractor, factor, cable maker and manufacturer," and endorsed by the Institution of Electrical Engineers of which he is equally proud to be a member.

Fredk. W. Purse,

West Ham, *October 28th*, 1924.

With the splendid record of electrical progress in Hackney behind him, the opinion of Mr. Robinson on the subject of electricity supply is one which must always claim attention; but one must suggest that to Mr. Robinson, looking down from the pinnacle of Hackney achievements, the concerted efforts of representatives of the industry in the remainder of Great Britain appear unduly small.

It would be out of place here to set forth the arguments justifying Regulations in our present scheme of existence. The fact that they are a necessary evil is fairly generally accepted, and one frequently finds that even those to whom all Regulations are anathema, are governed by such self-inflicted rules as that of regularly shaving each morning.

Confining one's remarks to the I.E.E. Wiring Regulations, although these run into 124 pages of literature (or 89, to be more precise) they "boil down" to a comparatively few fundamental requirements, *viz.*:—

(1) The protection of the insulation from ordinary risks of mechanical damage.

(2) The protection of the insulation from known causes of rapid deterioration.

(3) The provision of a sufficient amount of insulating material for it to function as such.

(4) Adequate precautions for preventing any metal liable to be touched from becoming alive, and for preventing the inadvertent handling of live parts.

(5) Precautions against fire risks, and burns.

These are all reasonable requirements, and without them the gas industry would be able to make as much capital out of the dangers of electricity as Mr. Robinson makes out of the dangers of gas. I suggest that the dangers of gas could be largely eliminated by regulations regarding the types of joints and taps, with a view to preventing leaks; and on the removal of fumes.

I do not know what method of wiring has been adopted by the Hackney electricity department, but it would be interesting to know to what extent it fails to conform to the I.E.E. Wiring Regulations. I suggest that it does not depart from them except on very small points which would not materially affect the cost. It would also be interesting to know, in the absence of any regulations, how Mr. Robinson prevents a prospective consumer from slinging in a medley of bell-wire and having it connected to the mains, which is what must occur if cheapness is the sole consideration.

My experience is that the user of electricity is never inclined to sacrifice the quality of his wiring to the price; he wants a good job at as low a price as possible, but he does not want the job cut down to a price, and not knowing anything about wiring, he is re-assured when he finds that the installation must conform to regulations. His procedure is to call on a contractor, unless the latter calls on him, and give an order for the work to be carried out. Without regulations, if he has been unfortunate in his choice of contractor, he gets a shoddy job at slightly less cost (or even slightly more if the contractor is a business man of real commercial ability) than a good job, whereas with regulations he gets a good job at practically the same price. The conscientious contractor, too, is protected from unfair competition, except in the matter of cheap labour, by these regulations. It is a fact that it is chiefly the reputable firms which carry out installations conforming to regulations that have remained in business, and the other type that figures in the bankruptcy proceedings.

In conclusion, I would suggest that the survival of the electrical industry is not altogether due to its marvellousness, but to the fact that the regulations have not been so crippling or hindering as Mr. Robinson imagines. Rather have they kept our electrical house in order and helped to build up that reputation for safety and reliability without which other efforts at progress would be unavailing.

Electricity in Circuits.

October 24th, 1924.

Harnessing the Severn.

The term "cruel fraud" is perhaps too strong to apply to what Mr. Stanley Baldwin had in mind when he made the speech from which an extract is given on page 612 in the ELECTRICAL REVIEW of October 24th; but it must be admitted that at some inquiries into the possible development of hydro-electrics, when others than Socialists were in power, there has been a tendency to exclude evidence that would not make the matter look better than it really is.

Eminent geologists and distinguished engineers are now being consulted about certain facts affecting the Severn Barrage, and any question coming strictly within their province must be regarded as being *sub judice* until these experts issue a report: but, as the Government is willing to pay £95,000 for "advice," possibly a part of this public money

may be saved if attention be called to facts about which little or nothing has been said by the promoters of this overrated tidal scheme, at present referred to a Committee set up under Mr. Albright. It would prove an expensive waste of time to examine surveys of catchment areas and to scan rainfall records, because the quantity of river-water, however great, is negligible in cases of tide-mills, as the effect of such water against a rising tide balances the useful effort of this water during ebb-tide.

About 45 years ago, in 1879 and 1880, a proposal was put forward by the late Lord Merthyr, who was supported by Sir D. Gooch, for damming the Severn at a point just above the mouth of the Wye, with the object of compressing air for mining purposes, while utilising the top of the dam as a railroad. Leaving aside the price of construction, which some people thought prohibitive, the estimated cost of keeping the impounded water agitated, in order to prevent the deposit of mud in suspension, was almost as large as for dredging away what would otherwise settle and accumulate above the dam. The scouring action of the Wye would probably help to remove "silt" below a dam built above the mouth of this river; but, after careful consideration, the whole thing was dropped because of the enormous amount of mud to be dealt with. Twenty years later Sir Benjamin Baker was called in to consider the damming of the Avon, for the benefit of Bristol; but he reported against it on identical grounds—mud and silt.

The same difficulty exists to-day; in addition to which shipping has increased very much, so that a dam would seriously interfere with navigation at an awkward spot where a vessel wants all the river to herself. A competent dredging engineer, Mr. Sidney Hunter, of Chalford, Glos., has investigated many of the troubles caused by silting between Sharpness and Gloucester, so there are actual results to warn those concerned against the destruction of property and loss of life due to obstruction on the part of such an apparently innocent looking thing as a bridge. To scour out a portion only of the silt from above a dam built for a 50-foot head, it would be necessary to run off to waste at least 10 feet of impounded water—thus reducing the head to 40 feet. By working turbines on a 20-foot head it would be possible to run machinery for two hours on each rise and fall of tide; say, 8 hours in all per 25 hours—*pace* those who recommend auxiliary pumps to prolong the agony!

More harm than good would be done to the electrical industry if connected with a £30,000,000 failure; and, on economic grounds, there is reason to expect that steam power stations, situated in the Glamorgan coalfield, could supply current at the proposed site of the Severn tidal-works more cheaply than it could be produced from a tide-mill on the spot.

Wm. H. Massey, M.V.O., M.Inst.C.E.

Twyford, *October 27th*, 1924.

Radio-Transformer Characteristics.

The suggestion contained in your postscript to my letter in your issue of the 24th inst. supplies just the information which the public requires. But why stop at l.f. transformers? I suggest that you should publish a list of defects that *might* be corrected by other defects, as *is* the case with achromatic lenses. For instance, I would suggest the following:—

If you have a bad aerial, be sure to have a bad earth as well; a satisfactory combination *may* result, which could not otherwise be obtained.

If your set is oscillating, use more reaction; a satisfactory combination *may* result, &c., &c.

The following also occurs to one as a natural corollary:—

If you are given the wrong number when making a telephone call, ask for a wrong number next time, and you *may* get the right one.

D. V. Onslow.

London, *October 27th*, 1924.

P.S.—It is needless to point out that all the above are based on the well-known universally applied theory that two wrongs make a right.

[Our correspondent is playful; but the facts remain. In our last issue Mr. W. K. Alford pointed out that "it does seem possible to strike a compromise to compensate for the mean loud speaker characteristic, which is not a straight line." That is our point.—EDS. ELEC. REV.]

Squirrel-Cage Motors.

Once again our old friend and hardy annual appears in the ELECTRICAL REVIEW of October 31st, 1924, Mr. Henry Joseph being the contributor on page 649. In all the controversy and comment which you have published, the whole appears to me to turn on the question of permissible amperes. All other issues being subject thereto, Mr. Joseph is loud in his praise of the "closed rotor" polyphase motor, but there is the other side of the picture. Personally, I do not favour clutches or clutch pulleys. Within the last year I have had to correct rotor faults, on both brazed and welded rotors. What virtue is there in a so-called indestructible rotor unless you can enshroud it in an indestructible stator? In two recent cases I have in mind the primary cause of failure was expansion. In one case both short-circuiting rings had fractured through, parallel to the rotor bars. In a second case the whole of the conducting element of a rotor had become excessively slack in the laminated iron element. Centrifugal force did the obvious. Result: Half a dozen rotor bars broken, stator windings so damaged as to necessitate a total rewind, and the off-side ball-bearing housing (Continental) smashed. I could repeat similar occurrences almost *ad infinitum*.

Recently, total failures in a large works were traced to a 50-h.p. 478-r.p.m. closed rotor motor whose normal full load was approximately 125 amperes, but the machine was thrown direct on the line by a switch only. As the motor had to start up some hundreds of feet of line shafting, &c., it was not surprising to find short-circuiting or stalling conditions prevailed, something like a thousand amperes being called from the line at starting. Can anyone wonder that the local protective flex functioned? It is not difficult to find conditions where a 2-h.p. motor of the type under review may be objectionable.

No hard and fast rule can be laid down. Apart from slightly lower efficiency and power factor, I submit that in the majority of cases a good make of wound rotor machine is quite as reliable as its closed rotor sister. Of course, a good case can be made out against shoddy brush gear, &c., of which there is plenty on the market. Of recent years much has been written and said concerning improvement of power factor, but the supply industry, as a whole, takes no notice, and continues to provide more ampere-carrying capacity in the streets. A few enlightened enthusiasts constantly preach capacity reactance as the economic remedy for exorbitant amperes prevailing in practically all a.c. systems. But when the absurdly low voltages of supply prevailing to-day for power purposes are considered the economic value of condensers frequently vanishes. Condensers are very expensive, even when about 400 volts is the pressure of supply. Further, it can be shown that by providing reactive capacity in series with the stators of squirrel cage motors, not only can the power factor be raised to a desirable degree, but the stalling torque of the motor can be appreciably increased, accompanied by much higher starting torque, simultaneously with keeping the starting current kept within reasonable magnitude. When the foregoing becomes fully appreciated the "pile on the copper" man will get the sack, and our friend with the closed rotor will have a larger proportion of the evidence in his favour.

W. E. Rogers, A.M.I.E.E.

London, *November 2nd*, 1924.

A Modern Electric Flat.

I have read Mr. Robinson's replies to my communications regarding the above.

I would refer Mr. Robinson to the last sentence in my letter which appeared in your issue of July 25th last, wherein I say: "By having a public test carried out we will arrive at some definite conclusion that cannot possibly be obtained through the columns of your journal." I still adhere to this, and surely if Mr. Robinson believes that his product is as good or even better than gas, he would be giving the vendors of electrical appliances and producers of "Juice" a boost up by accepting my challenge and proving once for all the true facts.

Mr. Walker, of Manchester, states: "Gas man had better look out, we are after him." Let me inform Mr. Walker that I am waiting anxiously, in fact I will come to him, Mr. Robinson, or any other person, who will accept my challenge.

Concluding, please note that so far as I am concerned the correspondence is now closed, unless it be to discuss the details, &c., for the test to be carried out.

Come on the electrical enthusiasts, show fight, don't waste pen and ink, a public test will settle the argument!

Sam. Hall.

Leith, *October 31st*, 1924.

Diesel-Electric Tug Trials.—Trial trips were made recently in New York Harbour of a new type of tug boat, the *Van Dyke* 3, owned by the Atlantic Refining Co. and propelled by Diese.-electric apparatus. This tug, the first of three to be built by the Staten Island Shipbuilding Co., is one of the first of its kind in the world; it is 97 ft. long and 20 ft. wide, requires a crew of but four men and no fireman. All contrcls are operated from the pilot-house. The propulsion equipment consists of two three-cylinder, airless injection Diesel engines, connected direct to two 155-kilowatt electric generators; all the electrical equipment was manufactured by the General Electric Co. of America. Among the electrical auxiliaries employed are a 1-h.p. motor for the fuel oil pump, a 5-h.p. motor for the compressor, a 3-h.p. motor for the bilge pump, a 3-h.p. motor for the circulating pump, an 80-h.p. motor for the fire pump, and a 3-h.p. motor for the steering gear. Connection is provided for supplying power to barges for electrically-driven cargo pumps. The tug will be used by the Atlantic Refining Co., with two others, to haul oil barges at Philadelphia, and is so equipped that its electrical power can be used to operate fire pumps and to drive cargo pumps on the barges which it hauls, for loading oil. The craft is also provided with "Siamese fire connections," enabling it to boost the water pressure of the wharf lines in case of fire duty.

Business Notes.

Bankruptcy Proceedings.—SAMUEL SHULMAN, dealer in electric lamps, 103, New Road, Whitechapel, London.—Under a receiving order made on the petition of the British Thomson-Houston Company, Ltd., creditors for £322, the first meeting of creditors in this case was held last week at the London Bankruptcy Court. The Official Receiver reported that it appeared from the debtor's statement that he was born in Russia and had not been naturalised in this country to which he came in 1895. He had been engaged as an electrician and in 1922 began to trade as a dealer in electric lamps imported from Austria. He conducted the business at 193, Bethnal Green Road, but within three months of beginning it an action was brought against him by the petitioning creditors for an injunction to restrain him from infringing their patent. He ascertained that he had no defence and consented to judgment and the costs of the action had been paid, while he understood that the damages had just been assessed. The present proceedings were in respect of the costs of an action for contempt of court. It was alleged that he was still infringing the petitioner's patent and judgment was given against him. The claim of the petitioners was his only liability. The case was left with the Official Receiver to be wound up in bankruptcy.

J. COWAN (National Electric Co.), electrical engineer, 2, Gothic Arcade, Snow Hill, Birmingham.—First meeting, November 10th, at the Official Receiver's Offices, 191, Corporation Street, Birmingham. Public examination, November 19th, at the Court House, Birmingham.

T. CARTER, electrical engineer, 2, South Street, Dorchester, and High Street, Swanage.—Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, released September 5th.

T. R. W. WYNESS and G. W. BALE (Wyness & Bale), electrical engineers, 13, Commercial Street, Brighouse.—Trustee, Mr. C. H. Baker, 1, Albion Street, Leeds, released September 12th.

R. E. HUGHES and R. Mc. L. ALEXANDER (R. E. Hughes and Hughes & Alexander), house furnishers and electrical and wireless engineers, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—Last day for proofs for dividend, November 12th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

C. PEACOCK, electrical engineer, 51, Gillygate, York.—Receiving order made October 23rd, on debtor's own petition.—First meeting, November 6th, at the Official Receiver's offices, Duncombe Place, York. Public examination, November 14th, at the Law Courts, York.

R. ROSE, electrical dealer and hairdresser, 10, Broughton Lane, Manchester.—First meeting, November 5th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, November 28th, at the Court House, Manchester.

R. BARNETT, electrical engineer, 104, Whitechapel Road, E.—Application for discharge to be heard November 19th, at Carey Street, W.C.

W. T. ROBINSON and H. ATTERBY (J. P. Beckett & Co.), electrical engineers, 134, Victoria Street, Great Grimsby.—Receiving order made October 24th, on debtors' own petition. First meeting, November 7th, at the Official Receiver's office, St. Mary's Chambers, Great Grimsby. Public examination, December 4th, at the Town Hall, Great Grimsby.

G. W. H. HANFORD (Radio Mfg. Co. and the O.I.C. Mfg. Co.), 37, Gold Street, Southsea.—Receiving order made October 23rd, on debtor's own petition. First meeting, November 12th, at the Official Receiver's offices, 87, High Street, Portsmouth. Public examination, December 1st, at the Court House, Portsmouth.

D. E. JONES (D. E. Jones & Co.), electrical contractor, 29, Carne Street, Pentre, Glamorgan.—Last day for proofs for dividend, November 15th. Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

A. G. INRIG (Globe Electrical Co.), electrical engineer, 46, Whitepost Lane, Victoria Park, E.—Supplemental dividend of 2¾d. in the £, payable at Carey Street, W.C.

H. P. GALT, electrical engineer, 56, Norbury Road, Thornton Heath.—First and final dividend of 11¾d. in the £, payable November 17th, at the Official Receiver's office, 29, Russell Square, W.C.1.

Company Liquidations.—WIRELESS CONSTRUCTION CO., LTD.—Winding up voluntarily. Liquidator, Mr. F. Morse, 1 and 2, Great Winchester Street, E.C.2.

STEARN ELECTRIC LAMP CO., LTD.—A meeting of creditors was called for November 3rd at 12, Grosvenor Gardens, S.W.

NEW ELECTRIC SIGN CO., LTD.—A meeting of creditors is called for December 1st at 4, Charterhouse Square, E.C., to hear an account of the winding up from the Liquidator, Mr. E. H. Hawkins.

WIRELESS VALVES, LTD.—Winding up voluntarily. Liquidator, Mr. G. W. Venson, 9, King's Bench Walk, Temple, E.C.

GLAIS ELECTRICAL CO., LTD.—A meeting of creditors was called for November 6th at 21, York Street, Swansea. Particulars of claims should have been sent to the Liquidator, Mr. B. Holbrook, Trebanos, Swansea Valley, by November 3rd.

BRISTOL INSTITUTE OF ELECTRO-THERAPEUTICS, LTD.—Winding up voluntarily. Liquidator, Mr. W. C. Smith, 25a, Whiteladies Road, Clifton, Bristol.

OLIVER-PELL ELECTRIC AND MANUFACTURING CO., LTD.—With reference to the notice published here last week, in order to prevent misunderstanding we are asked to state that this company and the Varley Manufacturing Co., Ltd., were amalgamated and the assets were purchased by Oliver-Pell Control, Ltd., in 1920.

Dissolution of Partnership.—BROWN & WILLIAMS, electrical engineers, 30a, Ebrington Street, and 43, Bath Place East, Plymouth.—Messrs. H. W. Brown and W. H. Williams have dissolved partnership. Mr. Williams will attend to debts and continue the business.

Trade Announcements.—THE BRITISH THOMSON-HOUSTON CO., LTD., has this week moved into larger premises at 26 & 27, St. Mary Street, Cardiff (telephone number: "Cardiff 5258"), where it has better storage and showroom accommodation for the convenience of trade customers in Cardiff and neighbourhood.

The chief offices of the BRITISH PLEVIUSIN CO., LTD., have been transferred to the Monton Works, Monton Green, Eccles, near Manchester.

MR. CHAS. P. COOK, A.M.I.E.E., for more than 20 years on the technical staff of Messrs. Veritys, Ltd., Aston, and for some years their motor works superintendent, has resigned, and entered into partnership with Mr. Walter Brettell, trading as T. & J. Brettell, general engineers and ironfounders, Spon Foundry, West Bromwich. The firm's speciality for the electrical trade will be soft grey iron castings.

Messrs. C. HAYWARD & SONS have opened an electrical engineering department in connection with their business in New Street, Ashford, Kent.

Messrs. E. A. GARDNER & SONS, LTD., have opened a wireless business at Brewer Street, Maidstone.

DEANS ELECTRICAL & ENGINEERING CO., LTD., has opened new premises at 35, Station Road, Doncaster.

Mr. P. COWELL has opened a wireless business at 19, Vale Road, Tunbridge Wells.

THE STELLA CONDUIT CO., LTD., has opened a new branch at 28a, Withy Grove, Manchester, at which address large stocks of conduits and fittings will be available.

The address of the ASSOCIATED PORTLAND CEMENT MANUFACTURERS, LTD. (Works Dept.), and of the BRITISH PORTLAND CEMENT MANUFACTURERS, LTD., is now Portland House, Tothill Street, S.W.1.

THE JERSEY ELECTRICITY CO., LTD., has opened offices and showrooms at the Albert Pier, St. Helier. Mr. F. M. Burrell has been appointed engineer and manager, and he will be pleased to receive catalogues and current prices of electrical goods.

MESSRS. BROWN, BOVERI & CO., LTD., have changed their name to British Brown-Boveri, Limited.

The business formerly carried on by the PARK ROYAL ENGINEERING WORKS, LTD., has been purchased by a new company, the Park Royal Engineering Co., Ltd., particulars of which appear in our "New Companies Registered" section to-day. The company informs us that the technical staff remains, and will be augmented. Considerable new plant will be added and improved organisation will be brought to bear upon the production of switchgear, instruments, railway signal apparatus, &c.

Catalogues and Lists.—THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—An illustrated booklet describing "Inducta" electric clock installations, together with a folder illustrating several designs.

MESSRS. L. JACOBS (LONDON), LTD., 5, Howland Street, Tottenham Court Road, W.1.—A pamphlet illustrating numerous designs of beaded shades for electric lighting.

MESSRS. PAPE & BENNISON, 23, Stanley Road, Barrow-in-Furness.—An illustrated price list of tools for the upkeep of commutators, slip rings, and brushes.

THE STERLING VARNISH CO., Royal London Buildings, 196, Deansgate, Manchester.—A pamphlet advertising "Sterling" insulating varnishes for traction motor windings.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Publications Nos. BC 3,425, BC 3,434, and BC 3,413, containing respectively illustrations, details, and prices of "Gecophone" radio receiving sets, loud speakers and amplifiers, and radio components.

THE LONDON FAN AND MOTOR CO., 81, Charlotte Street, Tottenham Court Road, W.1.—An illustrated price list of portable battery-charging sets and switchboards for the conversion of a.c. and d.c.

MR. ERNEST J. BATY, 157, Dunstable Road, Luton.—A priced leaflet dealing with radio components.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflets No. 1,028, describing the "U" type 15-kW transmitter; No. 1,035, dealing with 500-W portable and semi-portable stations; and No. 1,040, containing details of Marconi open aerial receivers.

THE QUEEN'S ENGINEERING CO., LTD., Queen's Road, Battersea, S.W.8.—A priced leaflet advertising small dynamos of from 40 to 1,000-W capacity.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—November price list of electrical supplies of all kinds. Illustrated.

PIGGOTT CONDUITS & CABLE CO., 24, New Bridge Street, E.C.4.—A trade price list of 600-megohm non-Association v.i.r. cables.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A series of forty "leaflets" issued to take the place of earlier publications. These cover the company's transformer, switch and control gear, and motor and generator manufactures.

THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—Illustrated pamphlets dealing with boiler valves and water and steam meter valves.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—Illustrated pamphlets advertising the "H.B." (Hamilton Beach) vacuum cleaner.

MESSRS. BELLING & CO., Derby Road Works, Montague Road, Upper Edmonton, N.18.—A priced and illustrated folder dealing with Belling electric fires.

Book Notices.—"Swedish Ports" (pp. 88, illustrated). Upsala, Sweden: Almqvist & Wiksells Boktryckeri A.B. (for the Swedish Board of Trade, &c.).—This profusely-illustrated publication describes in some detail the communications (internal and international) of Sweden, the free ports and harbours, as well as containing particulars of the Customs tariff, shipping dues, &c.

"Chemistry and Atomic Structure," by J. D. Main Smith. Pp xii+221; figs. 20. London: Ernest Benn, Ltd. Price 12s. 6d. net.

"The Electron," by R. A. Millikan. Pp. xiv+293; figs. 42. Chicago. Price $1.75, postage extra.

The *Punch* (Almanack Number), which is just issued (one shilling), is full of Christmas and other topical fun—perhaps a little better than usual.

"Broadcasting Time-Table and Reception Log," by R. Grierson. Pp. 24. London: Chapman & Hall, Ltd. Price 2s. 6d. net.

What America Wants.—According to the *Electrical World*, what America needs is a Henry Ford to make electrical appliances. We cannot say whether American electrical manufacturers will be prepared to support our contemporary's opinion, but we quote what that organ has to say on the matter:—"Henry Ford had a vision. He saw what it would mean to the people of America if it were possible for them to ride the roads in simple, economical self-propelled vehicles. Then he built a car that would run, but he was not content with that. He also built a market by making cars that were inexpensive as well as good, and selling them to thousands of people until to own and drive an automobile became a fad and set a social standard. The electrical industry is waiting for a man with this kind of commercial courage who will back its great vision of complete electrical equipment in the home, first with low-priced and dependable appliances that everybody can buy easily, and then with the kind of selling that will drive domestic drudgery out of the American home—not 'some day,' but now.

"There are 11,725,000 families connected to electric service lines in the United States to-day, of which but a small percentage are adequately equipped with appliances. Six million more homes lie within easy reach, but are still unwired. Every owner of these homes will ultimately spend as much for electrical appliances as he does for a Ford car. No one can say, therefore, that the market is not great enough to satisfy a large ambition. For we are not waiting for the public to decide to buy, but for the coming of a master market builder who will accomplish the task in the big way that has marked the astonishing evolution of the automobile industry. The American people will buy a full equipment of electrical labour-saving and comfort appliances just as readily as it has bought Ford cars, once the pleasures and benefits of 'doing it electrically' have been interpreted to it as efficiently as Ford has put before it the lure of the open road.

"There is nothing much the matter with electrical appliances to-day—large or small. They do their work well and become indispensable to every household that possesses them. The trouble lies in the fact that they are manufactured in too small volume and sold by tens where they should sell by thousands. As a result, the electrical industry to-day is actually not equipping homes as fast as they are being built. The industry is falling behind, not gaining on its market. It is failing to render in the fullest degree the great service to humanity of which it is so justly proud, because it is not making this benefaction popular. When will a Henry Ford rise up in the electrical industry and show how?"

American Lamp Patents.—The Save Electric Corporation has failed in its effort to obtain a reversal of judicial decisions adverse to it and in favour of the General Electric Company in a case involving infringement of the Just and Hanaman and other patents concerning incandescent lamps, these patents being controlled by the General Electric Company. The United States Supreme Court on October 20th declined to grant a writ of *certiorari* to review the case. The Save Electric Corporation alleged that all facts had not been developed fully before the lower courts.—*Electrical World.*

Turbine Tenders for Norway.—According to reports from Christiania, tenders were recently received for the supply of two of the eight turbines required for the Nore hydro-electric works. Each turbine unit will be about 36,000 h.p. The German firm of Voith quoted 644,000 kr., the Kristinehamn of Sweden 950,000 kr., the Kvaerner Bruk of Christiania 1,085,000 kr., Myrens Vaerksted 1,188,000 kr., and a Swiss firm 1,400,000 kr., all the prices being in Norwegian currency. The tenders include the amount of the import duty of about 13 per cent., and attention is drawn to the very low German offer. The tenders are now under the consideration of the State Water Powers Board, which controls the Nore works, and it is expected that the board will refer the matter to the Government for decision.

An Unsuccessful Venture.—In a recent bankruptcy case at Sheffield, a buttonhook and scissors manufacturer attributed his failure to a venture in an electrical business, bad trade, bad debts, and lack of capital. After between 30 and 40 years in business in the above trade, he purchased about four years ago for about £160 an electrical business, employing a manager. He had no personal knowledge of the business, and fifteen months later he had to close it down, a loss of £800 having been incurred.

Stable Government and Prosperity.—The great victory of the Conservative Party will be welcome to our readers chiefly because it removes, for the time being at any rate, the danger of unsound finance that would inevitably wreck the vast trade on which the whole country depends for its very existence. We do not take a reactionary view of public affairs; we have a great deal of sympathy with those—call them idealists if you will—who desire to improve the lot of the poorest class. Every great movement depends for its driving power on idealism. But idealism must be tempered by knowledge. The financial and commercial system by which nations exchange their commodities and service is far too intricate and far too delicate to withstand the shock of crude experiments. The greatest need of the world is stable conditions on which confidence, credit, and commerce can be re-established. Now that there is once again a prospect of stable government, let us devote our energies, our abilities, and our zeal to the discovery of a policy that will lead to greater prosperity for the whole community, a reasonable assurance that any man who is willing to do an honest day's work for a fair day's pay shall have an opportunity to do it, and that the proceeds of harmonious industrial co-operation shall be fairly distributed among all those whose efforts have made them possible. That will not be achieved by resting content with the laurels of victory, still less by exulting over the parties that have suffered defeat.—*The Times Trade Supplement.*

Dominican Electrical Imports.—An official American report shows that the value of electrical machinery imported into the Dominican Republic in 1923 was $117,072, as compared with $69,214 in 1922 and $293,807 in 1921. The origin of this is not detailed, but the report states that the United Kingdom held second place in the list of exporting countries, the United States being first.

German Foreign Enterprise.—It was recently reported from Amsterdam that sanction had been given by the Dutch authorities to the formation of a concern under the title of the International A.E.G. of Amsterdam, the promoters being the Berlin A.E.G. and the Amsterdamsche Bank. The share capital amounts to 10,000,000 florins. The object is the production and sale of electrical machinery, apparatus, &c. A second new scheme is announced from Belgrade, where, besides the existing Jugo-Slavian A.E.G., a concern under the title of the Technical Trading Co. (Tetrad) has been formed to represent the engineering, iron and steel, locomotive, and telephone and telegraph interests of the German Linke-Hofmann-Lauchhammer group, the Mix and Genest Co., the Upper Silesian Caro interests and the Archimedes Co. in the whole of Jugo-Slavia, with headquarters in Belgrade and branches in different parts of the country. It is proposed to establish a large factory in Belgrade for the production of telegraph and telephone appliances, there being no such works at present in Jugo-Slavia, and particular attention is to be devoted to the development of wireless systems. Mr. Ristitch, of the firm of that name, who formerly represented the interests of the A.E.G. in Serbia, has been appointed general director of the new company, which is opening a large store at Semlin for the exhibition of the products of the various firms embodied in the new undertaking.

Industry and the Election.—On the eve of the General Election the Federation of British Industries forwarded special communications to the leaders of the three political parties. It urged that the improvement of industry and employment was the one outstanding need of the country; that the services supplying industry with fuel, power, transport, and food, the most essential of all raw materials, should be economically and efficiently managed because upon the efficiency of such services depended the individual well-being of every person engaged in industry; and that hasty or ill-considered experiments might mean the misery of unemployment for many millions. The hope of the Federation in thus appealing to the political leaders was that they would be induced to make clear what was the attitude of their respective parties to these important questions.

Unemployment.—The total of unemployed persons registered on October 20th showed a further decrease, the number being 1,204,000, as against 1,210,200 a week earlier. The reduction since December 31st, 1923, was 81,623.

United States Electrical Exports.—In a review of the electrical exports of the United States during August, *Commerce Reports* shows a general improvement as compared with August, 1923. Generating equipment showed a considerable increase, and farm-lighting sets doubled in value. The exports of alternators of more than 2,000 kVA were valued at $240,892, as compared with $120,357, while transformers, converters, and rectifiers showed as great an improvement. Substantial increases are also reported in the cases of electric lamps, wiring materials, and radio apparatus. On the other hand, switchboard panels suffered a heavy decline, motors also fell in value, and there was a slight decrease in watt-hour meters.

Russian Notes.—*A New Electric Locomotive.*—As reported from Stockholm, a new type of electric locomotive has been designed by Prof. Lomonosoff, the Russian railway engineer who was associated a year or two ago with the allocation of orders to Swedish works for the delivery of a large number of steam locomotives for the Soviet railway system, which have now been practically completed. An experimental locomotive in accordance with the Russian engineer's designs is said to have undergone trials at Stuttgart recently under the auspices of a Russian commission and to have yielded satisfactory results. The engine is of the Diesel-electric type.

Promoting Expansion.—The Supreme Central Executive Committee has issued a circular to the local organisations of authority imposing upon the local executive committees the obligation to take all measures for facilitating the development of local electrification by co-operating in the equipment of stations of local importance and the extension of their capacity, and in increasing the number of consumers of energy in their respective localities.

The Regional Stations.—The completion is expected to take place next year of the following stations:—Volkhov and Utkin works for Petrograd, of a capacity of 54,000 kW; the Schatur for Moscow, of 48,000 kW, of which 5,000 kW is already in service; the Zemo-Avchali, near Tiflis, of 12,800 kW; the Nischni-Novgorod, of 20,000 kW; the Balaknin central station; the Shterov, in the basin of the Don, of 20,000 kW; the Yaroslav station, of 5,000 kW; the Lyapinsk station and certain others. The starting of these works will increase the productive capacity of the country by about 200,000 h.p. As is pointed out by a writer in a Moscow economic newspaper, hundreds of factories, works, and mines will then have to change over to the use of electrical power, and this will represent the first great connection between the electricity supply and other industries.

Considering the financial questions involved in the execution of these works, a recent report states that a sum of 1,362,000 roubles will be required solely for the electrical equipment of 12 industrial works in the area of the Nischni-Novgorod station, 1,450,000 roubles for the Red October station's consumers, and 3,000,000 roubles for works in connection with the electrical equipment of the mines in the Donetz basin. The funds for these purposes have not been provided, and no orders have been given for the plant, the construction of which would occupy a year at Russian works. The Supreme Council of National Economy has proposed to prepare the necessary estimates, and the General Electrical Commission has already begun to investigate the matter in some districts, but, in the opinion of the writer, these steps are far from being adequate, and it will be necessary to take action locally or the stations will have an insufficient load; it is suggested that the industries should help themselves by finding money for the work.

Late Shop-window Lighting.—The British Electrical Development Association has launched an after-business-hours shop-window lighting campaign. This is the third of its kind, the repetition being justified by the testimony received on previous occasions from suppliers and manufacturers of lighting fittings and time switches. A number of attractive pamphlets are available, and E.D.A. 517 gives the prices of quantities of these.

For Sale.—Messrs. George Cohen & Armstrong Disposal Corporation invite offers for a large number of transformers of all sizes up to 1,000 kVA, 6,300/440 V, lying at H.M. Factory, Gretna. Bristol Corporation Electricity Department invites offers for disused plant, including Willans engines, Siemens alternator dynamo condensing plant, &c. Darwen Corporation has for disposal one 200-kVA Dick, Kerr d.c. motor-generator set, with switchboard panel, &c. (See our advertisement pages to-day.)

Social Events.—The annual dinner of the Victoria Works Athletic Club (Johnson & Phillips, Ltd.) was held at Woolwich on October 24th. There was a large attendance of members and friends. The chair was occupied by Mr. H. J. Sheppard (president of the club), supported by Mr. C. Stewart (co-president), Messrs. Pearson, Porteous, Orton, Stigant, Cridge, and Wilson (vice-presidents), Mr. W. Burge (club chairman), Mr. W. A. Booth (vice-chairman), and Mr. W. F. Smith (club secretary). The club's fine record in heading the Southern Suburban Football League, and being the runners-up for the Crossley Cup and the Charlton Charity Shield, was detailed by the chairman, and evoked much enthusiasm. Reference was also made to the past, present, and future activities of the club in cricket, tennis, and hockey. Mr. Sheppard promised a continuance of the warm sympathy and practical support which the directors of the company had always extended to the club. An excellent musical programme was provided.

Buenos Aires Electrical Works.—It is stated that the Compania Hispano-Americana de Electricidad, of Madrid, proposes to make an increase in the share capital for the execution of works, chiefly in Buenos Aires, where the old generating stations are no longer sufficient for meeting the growing demand and require an extension of their capacity.

British Empire Exhibition Note.—The Exhibition was formally closed on Saturday last by the Prince of Wales. In his speech the Prince mentioned that nearly eighteen million people, of whom five million were children, had visited the Exhibition during the six months of its run. His Royal Highness said he understood that negotiations were taking place with a view to giving consideration to the question of re-opening the Exhibition next year.

Local Exhibition.—DUNDEE.—A trade exhibition of radio apparatus is being held shortly. The arrangements are being made by Mr. J. B. Watson, South Lindsay Street, Dundee.

Rumanian Oilfields.—According to the *Financial News*, engineers of the Metropolitan-Vickers Electrical Co., are at present engaged in a survey of the Roumanian oilfields, with a view to the elaboration of a comprehensive electrical power scheme, which it is anticipated will lead to big business.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned.

Deco (lettering and design). No. 444,788. Class 6. Transporting machinery, conveying machinery, hoists and elevators, all being electrical goods, cable drums, trolley heads, collector or slip-ring columns, and brake gear, being parts of electrically-operated cranes or conveyors.—Joseph Palin, trading as the Dalyte Electrical Co., Deco Engineering Works, West Row, North Kensington, London, W.10. October 29th, 1924.

U.S. (lettering and design). No. 445,492. Class 8. Apparatus for use in wireless telephony and telegraphy.—The firm trading as Urech Supplies, 155, High Street, Lewisham, London, S.E.13. October 29th, 1924.

Powercryst. No. 451,784. Class 8. Apparatus for use in wireless telegraphy and telephony.—U.S. Radio, Ltd., 155, High Street, Lewisham, London, S.E.13. October 29th, 1924.

Concord (lettering and design). No. 451,875. Class 8. Flexible insulated electric cables and wireless head-phone connecting cords.—Hector Graham Munro, 58, St. Vincent Street, Glasgow. October 29th, 1924.

Sphinx (lettering and design). No. 430,538. Class 13. Electric automobile lamps. No. 436,656. Electric lamps included in Class 13.—Auto-Bulbs, Ltd., 14-17, Holborn Viaduct, London, E.C.1. October 29th, 1924.

Cobalite. No. 450,973. Class 13. Electric bulb lamps.—George Staples Prowett Ferdinands, The Nest, Coldharbour, near Dorking, Surrey. October 29th, 1924.

Unalux (lettering and design). No. 450,689. Class 15. Glass globes and shades used for lighting purposes.—The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. October 29th, 1924.

The Original Peerless Leatheroid Insulation. While I Live I'll Crow (lettering and design). No. 449,358. Class 39. Leatheroid, being electrical insulating paper.—Attwater and Sons, Hopwood Street Mills, Preston. October 29th, 1924.

Panalite. No. 442,657. Class 40. Vulcanite sheets and slabs.—William Maitland Edwards, 3, Palace Chambers, 9, Bridge Street, Westminster, S.W.1. October 29th, 1924.

Westoco. No. 451,395. Class 50. Electrical insulators and electrical insulating substances, all composed of a compressed composition with a fabric foundation.—The Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, King's Cross, London, N.1. October 29th, 1924.

Private Arrangements.—PERONET, LTD., wireless manufacturers, 38, Bloomsbury Square, London, W.C.—The adjourned meeting of the creditors of the above was held recently at the offices of Messrs. H. Crafter & Co., 35, Bloomsbury Square, London, W.C. At the first meeting it was stated that the liabilities totalled £6,759, of which £1,877 was due to the trade, whilst the net assets were £890, or a deficiency of £5,869. The meeting had been adjourned and a committee appointed with a view to an offer being submitted. Prior to the adjourned meeting, a circular was issued to the creditors by the solicitors, in which they stated that they were in a position to arrange for the immediate taking over of the debts against the company. It had been only with the greatest difficulty that they had been placed in funds to enable them to pay as much as 5s. in the £ for the debts, and they hoped later to be able to raise funds for working capital to improve the company's position. At the meeting the solicitors stated that a large number of the creditors had already assented to the proposed composition of 5s. in the £, which would be payable in cash forthwith. Approval was expressed of the proposed composition.

New Swiss Company.—A new company has lately been formed at Stafa with the title Schweizerische Gesellschaft für Electrische Bedarfsartikel Saafa, to manufacture electric lamps, switches, and other electrical apparatus.

Battery Supports.—In connection with the large battery of accumulators that is being supplied for the Hull Corporation, reference was made last month to the fact that the Chloride Electrical Storage Co., Ltd., was introducing tall pedestals made of glazed stoneware surmounted by porcelain insulators for supporting the cells in place of the usual wooden stillage. We are now informed that the insulators in question are being manufactured at the Lambeth works of Messrs. Doulton & Co., Ltd.

Australian Electrical Imports.—The imports of cables and covered wire into Australia during the year ended with June last are officially returned at a value of £3,564,000, as compared with £3,383,828 in the preceding year. During the same period the imports of electrical machinery into the Commonwealth advanced from £1,208,334 to £1,274,449.

New Belgian Company.—The Société Internationale d'Energie Hydro-électrique has been formed at Ixelles (46, Rue de Naples), with a capital of 162,500,000 fr., to "carry out all operations appertaining to the transport of current in Belgium and abroad."

Gutta-Percha.—At a meeting of the Institution of Rubber Industry on Monday last, Mr. C. W. H. Howson, B.Sc., read a paper on "Gutta-Percha: Preparation and General Properties."

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 4th.—Copper (electrolytic) bars, £68 10s., 10s. increase; do., do., sheets, no change; do. do., wire rods, £78 10s., 10s. increase; do. do., h.c. wire, 9 13/16d., ¼d. increase. Messrs. James and Shakespeare report November 5th.—Copper bars (best selected), sheet and rod, no change. English pig lead, £39 15s., 15s. increase on last week's quotation.

Strike at Barking Station.—On Monday last a number of the men engaged on constructional and electrical work at the new Barking station of the County of London Electric Supply Co. ceased work, owing, it is said, to the employment of men from the north of England at rates lower than those prescribed for the London area. It is probable that a serious extension of the strike will occur if a settlement is not reached quickly. A meeting of the Engineering Employers' Federation was called for yesterday (Thursday) to consider the matter.

Lighting and Power Notes.

Aden.—According to *Indian Engineering*, arrangements have now been made for the supply of electricity in the Settlement and Cantonment of Aden, and it is expected that the scheme, which will be financed by a loan from the Government of Bombay, will be completed by September of next year. The contracts for the plant were detailed in our issue of September 26th, p. 474.

Argentina.—HYDRO-ELECTRIC SCHEME.—According to *Commerce Reports*, a Bill has been submitted to Congress by the deputies from the Province of Tucuman which would provide for a bond issue of 25,000,000 pesos (paper) to be used in the construction of two hydro-electric stations and irrigation dams, one on the Sali River to develop 20,000 h.p. and the other on the Marapa River with a capacity of 10,000 h.p.

Barrow.—ELECTRICITY SUPPLY.—The Town Council has adopted a report submitted by the electrical engineer for the extension of the electricity supply to Grange, Ulverston, Dalton, and to a number of mines and quarries in North Lancashire, and application is to be made to the Electricity Commissioners for sanction to the borrowing of £47,700 to carry out the scheme.

Blackpool.—LOAN.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £6,000 for meters.

Continental.—FRANCE.—The Société Hydro-Electrique of Lyons has applied for a concession to set up a 60,000-V transmission line from Lyons to Vienna to supply the intervening districts with electricity. A transformer station to step down the current to 10,000 V is to be erected at the latter city. The Société Régionale d'Electricité has also applied for a concession to supply electricity in the departments of Isère and Rhône.

A concession to supply 39 townships in the department of the North has been applied for by the Société Béthunoise d'Eclairage et d'Energie, of Bruay en Arbois (Pas-de-Calais).

In order to provide the necessary power for the extensions which are taking place in connection with the collieries of the Société des Charbonnages de Courrieres in the Pas de Calais Department of France, a fourth set is being added to the company's power station at Harnes. The plant already in operation comprises three 10,000-kW turbo-alternators; the buildings have, however, been designed to accommodate plant with a total capacity of 60,000 kW.

SWITZERLAND.—Plans have been prepared for the establishment of a new hydro-electric power station at Altmatt in the Canton of Schwyz, which, when completed, will be connected up to the system of the North-East Swiss Power Supply Co.

BELGIUM.—According to the report for the year ending June 30th last of the Compagnie d'Electricité de la Dendre, the company is now supplying energy to 14,578 consumers, an increase of 1,690 during the past 12 months. The output of the company's generating station during the year amounted to 11,756,830 kWh, as compared with 8,438,410 kWh in 1922-23. The length of the h.p. cables and overhead mains owned by the company is now 180 miles and of the l.p. mains 162 miles. In order to meet the increasing demand, the capacity of the plant at the generating station is being raised to 15,000 kW.

CZECHO-SLOVAKIA.—To facilitate the supply of electricity to small towns and villages, the Government has decided to increase the subsidies granted to rural networks from 20 to 50 per cent. of the construction cost.

RUSSIA.—The large hydro-electric power station on the Volchov river in the vicinity of Leningrad is nearing completion. The Allmänna Svenska Elektriska Aktiebolaget, Nydqvist och Holm, and Karlstads Mekaniska Verkstad have been the chief suppliers of turbines and generators. The power station will start working in December, 1925. The saving in coal will at first amount to 180,000 tons a year; this figure will later on be raised to 320,000 tons, and, after the regulation of Lake Ilmen, to 530,000 tons.—*Reuter's Trade Service* (Stockholm).

Irish Free State.—SHANNON ELECTRICITY SCHEME.—It is reported that the four Continental experts employed by the Irish Free State Government to examine the scheme of Messrs. Siemens, Berlin, for the harnessing of the River Shannon for electrical power purposes have approved of the scheme, and have so reported to the Executive Council (Cabinet). The Government is now considering whether money shall be provided from public or private sources, but whatever the ultimate decision, it will retain a controlling interest. Dr. Borgquist, the Swedish expert, expressed the opinion that the Shannon scheme was the only one that would serve for national industrial development, and that no other water power to be of service in that way could be transmitted to Cork. Smaller sources of water power could be drawn upon in Counties Galway, Kerry, Kilkenny, and Wexford to feed the national distribution network.

Kettering.—LOANS.—The Electricity Committee has recommended to the Town Council that application be made to the Electricity Commissioners for sanction to the borrowing of £7,122 for further development of the electricity supply in Barton Seagrave, Broughton, and Braybrooke, and £15,700 for mains and services.

Leicester.—ELECTRICITY *v.* GAS.—A special committee, recently appointed by the City Council to consider the question of the production and distribution of energy for lighting, heating, and power by the Electricity and Gas Committees, particularly as to whether it is economical to define, limit, or encourage competition between the two, has submitted a report in which it is recommended that the Housing Committee might experiment with two houses, one "all-gas" and the other "all-electric."

Looe.—PROPOSED ELECTRICITY SUPPLY.—The Urban District Council has received the draft of an agreement in connection with the proposed electricity scheme. The contractors propose to supply electricity to private consumers at 6d. per kWh for lighting and 2½d. per kWh for power, and on receipt of an Order authorising them to carry out the scheme are prepared to install temporary plant immediately to supply urgent needs.

Luton.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Town Council to extend its area of electricity supply so as to include the borough of Dunstable, the urban districts of Leighton Buzzard and Linsdale, the rural districts of Luton, Eaton Bray, and Wing, and part of the rural district of Hemel Hempstead.

Plympton St. Mary.—SPECIAL ORDER.—The Rural District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in its area.

Salford.—AN ELECTRICAL CONTRACT.—At the meeting of the Salford Town Council on Friday last week a discussion took place regarding the tender of a London firm for plant to be erected at the new Agecroft electric power station. Referring back a recommendation of the Electricity Committee that the tender in question should be accepted, Councillor Gorman said he had been unable to obtain information which would show that the standard rate of wages was being paid at the firm's works. Under the Fair Contracts Clause they were entitled to know all the places where the work was in progress, but apparently the firm let sub-contracts and had no works of its own. The motion was defeated. Alderman Billington, chairman of the Electricity Committee, said the firm did not construct plant—it designed it—and it would have to make the usual declaration. He promised to supply the names of all the subsidiary firms when his department secured them.

South Africa.—JOHANNESBURG.—In connection with the Electricity Commission's proposal that the town should link up with the Victoria Falls and Transvaal Power Co., Ltd., and take an electricity supply from Witbank power station, the *South African Mining and Engineering Journal* states that

the Town Council has declined the Commissioners' offer and is applying to the Administrator of the Transvaal for authority to erect a new municipal power station at a cost of £525,000.

ELECTRICAL DEVELOPMENT.—At the end of March last there were 149 electricity undertakings in operation in South Africa, an increase of eight during the year. The value of the output is, however, returned at only £3,797,327 for 1923-24, as against £3,851,135 in 1922-23.

Southport.—EXTENSION OF MAINS.—The Electricity Committee proposes to extend its electricity mains in the Kew district, and has recommended to the Town Council that application be made to the Electricity Commissioners for sanction to the borrowing of £4,727 to carry out the scheme.

Tetbury.—CORRECTION.—In our issue of October 24th we inadvertently referred to the inauguration of the "Urban District Council's" electricity supply undertaking. The supply is being given by the Tetbury Electric Supply Co., Ltd., formed under the auspices of the Western Electric Distributing Corporation, Ltd.

Ticehurst.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising Major B. J. Day and Lieut.-Col. C. B. Bartley to supply electricity within the rural district.

Tramway and Railway Notes.

Blackpool.—LOAN.—Application is being made to the Ministry of Transport by the Corporation for sanction to the borrowing of £10,500 for the purchase of six new tramcars.

Bolivia.—As a solution of the operating problem caused by the steep grades on the La Paz-Yungas Railway, it is proposed to electrify it, a preliminary survey having shown the feasibility of such an electrification from La Paz to Coroico. Estimates of the cost vary from $2,000,000 to $3,000,000.—*Commerce Reports.*

Continental.—BELGIUM.—The abandonment of the Nord-Midi junction railway scheme has been followed by the bringing forward of proposals for the establishment of underground lines. In this connection the Société d'Electricité et de Traction states that a scheme for a metropolitan line, by utilising a part of the works carried out with a view to effecting a junction between the stations of the Nord and the Midi, has recently been put forward, and the principle of this means of transport seems to have been favourably received by the interested administrations and by the public. The company prepared a preliminary scheme for a metropolitan line traversing the city last year, but abstained from presenting it when the Government announced the abandonment of the work on the junction. Now the company sets forth particulars of its scheme which would provide for the construction of a metropolitan line partly underground and partly on the surface.

SPAIN.—The North of Spain Railway is electrifying the Pájares ascent on its line, over which Asturian coal has to pass on its way to the centre of the peninsula. When the scheme is completed this section will be able to deal with three times the present traffic and time will be gained in transport. —*Reuter's Trade Service* (Madrid).

London.—EQUIPMENT FOR TRAMWAY DEPOTS.—The Highways Committee of the L.C.C. has recommended that a hand-operated crane at Clapham car-shed be adapted for electrical operation and substituted for the hand-operated crane at present at the Poplar depôt, at an estimated cost of £1,500; that improvements be carried out at the Deptford depôt, at an estimated cost of £13,482; and that a shed be erected for the storage of special track work, and an electric crane installed at the Rye Lane depôt, at an estimated cost of £8,518.

London, Midland & Scottish Railway.—ELECTRIFICATION.—According to *The Times* Manchester correspondent, the L.M. and S. Railway Co. has announced that it is about to proceed with the electrification of the line between Manchester, Oldham, and Shaw. The length of the route is about 12 miles, and the expenditure is estimated at £600,000. An effort is to be made to complete the electrification by the end of 1925. The scheme will include the construction of a new station at Shaw, the intended terminus of the present electrification, the electrification of a network of sidings at Newton Heath, the branch from Royton Junction to Royton, and the loop *via* Irk Valley Junction and Thorpe's Bridge Junction. Additional lines at Victoria Station, Manchester, will be electrified, and a new sub-station will be required at Oldham (Werneth). The side-contact rail system will be adopted.

Manchester.—NEW ROUTE.—The Tramways Committee, on October 28th, decided to proceed with the construction of a new tramway route along Princess Road, authorised in last year's Parliamentary Bill. The track will be laid on sleepers across Wilbraham Road to Barlow Moor Road. The cars will run along lines which will not be available to other traffic, which will be accommodated within defined areas on each side of the track, crossings being provided about a quarter of a mile apart.

Oldham.—YEAR'S WORKING.—We have received from Mr. W. Chamberlain, general manager of the Corporation tramway undertaking, a copy of the report for the year ended March 31st last. The total revenue amounted to £219,892, as compared with £241,651 in the preceding year. Working expenses totalled £176,985, as against £179,572, leaving a gross profit of £42,907 (£62,079). After deducting interest, sinking fund, and other charges, there was a net surplus of £9,388, as compared with £18,544 in 1922-23. The number of passengers carried increased from 32,140,449 to 33,410,901. The Ashton-under-Lyne Corporation is seeking powers to run railless cars between Ashton-under-Lyne and Oldham, and provision has been made in the Bill to enable the latter Corporation, along with Ashton, to maintain a regular service between the two towns.

United States.—NEW TYPE OF ELECTRIC LOCOMOTIVE.—Seven electric locomotives of a new type have been ordered by the New York, New Haven, and Hartford Railroad from the General Electric Co. Each will be a "travelling sub-station" capable of picking up alternating current at 11,000 volts from the overhead wires and changing it to the direct current which will be used to operate the driving motors.—*Reuter's Trade Service* (New York).

Telegraph and Telephone Notes.

China.—LONG-DISTANCE TELEPHONY.—A scheme to link Pogranichnaya, on the northern border of Manchuria and Siberia, with the western terminus of the Russian railway line in Manchuria and the Chinese Eastern railway, by a long-distance telephone line has been planned by the French consul at Kharbin (M. Lepissier). Eventually this telephone line will be extended to Vladivostok and westward to Chita. Capital to realise the scheme will be supplied by a Franco-Chinese company to the amount of 1,000,000 yen. The whole of the telephone network is to pass into the hands of the Chinese in 16 years.

South America.—NEW COLOMBIA RADIO STATION.—A new radio station is about to be established in Colombia. The site chosen is in Ibagué, the capital of the Department of Tolima.—*Reuter's Trade Service* (Bogota).

Latvia.—AUTOMATIC TELEPHONY.—The Cabinet of Ministers, at its last sitting, pronounced in favour of the installation of an automatic telephone station at Riga. If the price is too high and the payment terms of the contractors are not acceptable, a semi-automatic system will be installed. The Minister of Transport is entrusted with this matter, with whom those interested should communicate.—*Deutsche Technische Warte.*

Radio Notes.

Broadcasting in England and the U.S.A. — CAPT. ECKERSLEY'S IMPRESSIONS.—The B.B. Co. has issued a statement with regard to the impressions formed by Capt. P. P. Eckersley as a result of his recent visit to America. He is of the opinion that English broadcasting cannot in any sense of the word be said to be behind American, but the problem is different on this side. The area of America is hundreds of times greater than the British Isles, and the average American listener is probably keener on the hobby side of broadcasting than upon its artistic aspect. Receivers are all designed for long-distance reception, and not to give pure reproduction in the same way that the problem has been tackled in England. Unity of control is vastly superior to the happy-go-lucky American method. There are said to be 550 odd stations in America, but it is admitted that perhaps at the most only 100 of them can in any way compare in power or programme with our main stations. Stations divide time constantly—that is to say, they do not all work at once, so that the variety of programme that has often been talked of, although it is sometimes greater than that in certain parts of England, is in general less than has been thought. With regard to linking up Britain and America, tests have been arranged between the two countries, but it is unlikely that any guarantees whatsoever can be made at present.

Germany.—"FISHY TALK."—The fishery authorities are using the Hamburg broadcasting station to promote the sale of fish, and in two recent announcements gave the catch of the day, the retail price in 214 shops, and details of the herring's life history. Every Monday and Wednesday a short, popular "fish talk" is provided. The broadcasting campaign is stated to have increased the demand for fish.

"WIRED WIRELESS."—Prince Reuss is reported to have made successful use of the high-pressure power conductors for transmitting broadcast programmes, the receiver being connected to the ordinary lighting circuit.

India.—BROADCASTING CONTROL.—In reply to the Government's circular on broadcasting in India, the Radio Club of Bengal has expressed the opinion that control should be in the hands of a public company under Government supervision and formed on the lines of the British Broadcasting Co. in Great Britain, but with provincial councils to watch

local interests. No monopoly should be granted to any one company for the sale of receiving apparatus, but the public should be allowed absolute freedom as to the type of set they wish to make or purchase. There should be no restrictions on the import of goods, but a duty of 7½ per cent. on complete sets and 5 per cent. on accessories should be charged, 80 per cent. of which should go to the broadcasting company. All persons using radio apparatus should be compelled to take out a licence at a cost of 10 rupees per annum, 80 per cent. of which should go to the broadcasting company.—*Commerce Reports.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—November 22nd. Electricity Department. One 60-ton electrically-operated overhead travelling crane. (See this issue.)

Argentina.—BUENOS AIRES.—December 22nd. National Sanitation Works. Two sets of electrically-operated centrifugal pumps.*

Australia. — MELBOURNE. — Electricity Commission, &c. January 12th, 1925. Switchgear and accessories. (October 24th.)

January 21st. Commonwealth Postmaster-General's Department. Automatic c.b. telephone equipment for the offices of the Minister of Public Works, N.S.W. Twenty-five private automatic branch exchange equipments.

Batley.—November 17th. Electrical engineer's work required in extension of the Batley and District Hospital. Messrs. W. Hanstock & Sons, hon. architects, Branch Road, Batley.

Belgium.—BRUSSELS.—November 18th. Ministry of Railways, Marine, Posts and Telegraphs. Table telephones and sets of jacks.*

November 19th. Belgian State Railway authorities at La Salle Madeleine, Brussels. Electro-mechanical railway signalling apparatus. Particulars (Cahier des Charges Special No. 20-346, du Service des Voies et Travaux des Chemins de Fer de l'Etat Belge) for 6½ fr.

November 27th. Municipal authorities of Schaerbeek. Establishment of a special telephone system to link up the various transformer stations in the town. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

Bradford.—November 15th. Tramways Committee. Stores for 12 months, including lampholders, electrical fittings, &c. Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Bristol.—November 21st. Electricity Department. Coal-discharging plant. (See this issue.)

Chile.—SANTIAGO.—Port of Constitucion. Semi-portable steam engines, electric generators, &c.*

Croydon.—November 22nd. Tramways Department. Thirty complete bodies for electric tramcars, 30 complete sets of traction bogie trucks, magnetic track and wheel brake equipments for 30 electric tramcars, 30 complete sets of electrical equipment for tramcars. Tramways manager, Tramway Offices, Thornton Heath.

Dublin.—November 10th. Great Northern Railway (Ireland). Stores for six months, including electrical fittings, lamps, cable and wire, &c. (October 24th.)

November 14th. Commissioners of Public Works. Electrical work and supplies (excluding lamps) required in the Dublin district for a period of six months from December 1st, 1924. Form and schedule from Mr. J. J. Healy, secretary, Office of Public Works, Dublin.

November 12th. Dublin United Tramways Co. (1896), Ltd. Supplies for 12 months (including electric lamps, electrical fittings, &c.). (See this issue.)

Dundee.—November 17th. Electricity Department. E.h.p. switchgear. (October 24th.)

Town Council. Electric lighting installation at Loons Road and Broughty Ferry housing schemes. Particulars from Mr. G. Baxter, Director of Housing.

November 25th. Harbour Trust. Electrification of new wharf, including sub-station equipment, cables, &c. (See this issue.)

Eccles.—November 12th. Health Committee. Installation of electric light, wiring, fittings, and distributing mains for 176 houses being erected on Peel Green housing estate. Specifications and form of tender from Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Gravesend.—November 12th. Board of Guardians. Electric lighting installation at Trafalgar Road Institution. Mr. G. Smith, acting clerk, 21, Stone Street. (Returnable deposit of £2 2s.)

Hale.—November 14th. Urban District Council. Equipment of an air-compressing station at the sewage disposal works. (October 24th.)

London.—HOLBORN.—November 12th. Board of Guardians. Electric lighting installation at the City Road Institution, Shepherd's Walk, N.1. (October 31st.)

Mold.—December 6th. Urban District Council. Works and apparatus in connection with the distribution of electricity in the urban district. (See this issue.)

New Zealand.—AUCKLAND.—December 11th. City Tramway Department. One motor generator, one 30- and one 5-h.p. motors, switchboard, portable electric drill, and travelling hoist.*

South Africa.—JOHANNESBURG.—November 17th. Municipal Council. Electric arc-welding generator set, complete with all accessories.*

SOUTH AFRICAN RAILWAYS AND HARBOURS BOARD.—November 24th. Converter plant, switch cubicles, transformers, and motors.*

December 10th. Electrification of Cape Town suburban railways. 83 motor-coach underframes (steel) and 83 motor-coach bodies (wood or, alternatively, steel); bogies and electrical equipment are not included. Specifications from the Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2.

CAPE TOWN.—November 18th. City Council. Electric motors.*

GEORGE, CAPE PROVINCE.—December 21st. Municipal Council. Establishment of an electric lighting and power undertaking for the Council, including erection of power station and supply of necessary plant, &c.

Stainforth.—November 18th. Education Department. Electric lighting installation at the new school. The secretary, Education Department, County Hall, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Birmingham.—Salvage Department. Accepted:—

Complete electrical plant, including two 100-kW steam generating sets, h.p. transformer, rotary converters and two wire balancer sets for electric vehicle charging, control gear, &c.—United Electrical Co. (Birmingham), Ltd.

Dundee.—Electricity Committee. Accepted:—

Four transformers (£855).—Swedish General Electric Co., Ltd. The transformers will be made in this country.

Two sets of switchgear (£1,104).—British Thomson-Houston Co., Ltd. The offers ranged up to £2,180.

Irish Free State.—DUBLIN.—We are now informed that the contract for electric lamps for the Department of Public Works and the Irish Post Office was placed with the Sphinx Electric Supplies (Ireland), Ltd., and not Auto Bulbs, Ltd., as stated here last week.

London.—STEPNEY.—Electricity Supply Committee.

Switchboards at Limehouse generating station :—

General Electric Co., Ltd.	£571
Bertram Thomas. (Accepted.)	665
Ferguson, Pailin, Ltd.	745
Edison Swan Electric Co., Ltd.	769

2 tons plumbers' solder and ½ ton tinmen's solder (£240).—G. Pizey and Son. (Accepted.)

Terrazzo flooring at Limehouse generating station (£307).—Fennings and Co., Ltd. (Recommended.)

50 tons of pitch (£158).—Crow, Catchpole & Co., Ltd. (Recommended.)

1,000 rolls 1-in. white tape (£82).—W. White & Co. (Recommended.)

Manchester.—Electricity Committee. Accepted:—

For Barton station :—

Air compressor pipework.—J. Spencer, Ltd.

Non-automatic air compressor plant.—Ingersoll Rand Co., Ltd.

For sub-stations :—

Transformer oil purifying equipment.—De Laval Chadburn Co., Ltd.

H.p. switchgear.—Ferguson, Pailin, Ltd.

Three 500-kVA transformers, two 250-kVA transformers.—Ferranti, Ltd.

Two 250-kVA transformers, one 125-kVA transformer.—Hackbridge Electric Construction Co., Ltd.

Two 125-kVA transformers.—Fuller Electrical & Manufacturing Co., Ltd.

Two 125-kVA transformers.—C. A. Parsons & Co., Ltd.

Coal.—100 tons per week for six months of washed slack at 22s. per ton.—Hulton Colliery Co., Ltd

Kiverton Park slack at 18s. 3d. per ton.—J. Roscoe & Co., Ltd.

5,000 tons of washed slack at 23s. 6d. per ton.—Clifton & Kersley Coal Co., Ltd.

Annual contracts (12 months) :—

Incandescent lamps.—W. E. Beardsall & Co., Ltd.; Drake & Gorham (Wholesale), Ltd.; Howarth Green & Co., Ltd.; Stella Lamp Co., Ltd.

Salford.—Education Committee. Accepted:—

Electric lighting installations at the undermentioned schools:—Higher Broughton school (£106), C. Walton & Co.; Ordsall boys' and junior mixed school (£168); Ordsall girls' and infants' school (£152), Ford Electrical Co., Ltd.

Electricity Committee. Accepted :—

Coal storage and reclamation plant at Agecroft power station (£4,683).—Mitchell Conveyor & Transporter Co., Ltd.

1,000 yd. 0.225 sq. in. l.p. cable (£132).—Hackbridge Electric Cable Co., Ltd.

3,000 yd. l.p. cable (£682), 500 yd. h.p. do. (£105), 1,900 yd. .2 sq. in. e.h.p. 3-core paper-insulated plain lead-covered cable (£1,388), 650 yd. .2 sq. in. l.p. paper-insulated plain lead-covered concentric cable (£247).—W. T. Glover & Co., Ltd.

500 yd. 3-way, 3½ in. stoneware conduits (£132).—Doulton & Co., Ltd.

Wolverhampton.—Town Council. Accepted:—

Apparatus and batteries for a fire and police alarm system (£1,652).—Walters Electrical Manufacturing Co., Ltd.

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Water-Power and Industry in Quebec.

THE large and efficient hydro-electric system of Ontario has been dealt with on more than one occasion in our pages. It is the purpose of this article to remind our readers that Ontario is not the only province of the Dominion of Canada in which very full advantage has been taken of that copious natural source of power. In Quebec, as opposed to Ontario, development has been left in the hands of private companies, and the results are equally satisfactory. The two instances are not altogether comparable, however, for whereas in Ontario the aim has been to supply electricity to the whole of the population, in Quebec, while this side of the question is not neglected, the provision of cheap energy for industry has been the main purpose.

Fig. 1.—The Shawinigan Falls Power House.

The principal operating company in the province, the Shawinigan Water & Power Co., whose station is illustrated in fig. 1, first supplied electric power 22 years ago, developing 10,000 h.p. at Shawinigan Falls by means of two 5,000-h.p. units. Three years later a 50,000-V transmission line was built to supply the City of Montreal, 85 miles away. The capacity of the generating station was gradually increased until in 1909 it reached the total of 58,500 h.p. The story of this company is one of steady progress and great engineering achievement. The City of Shawinigan Falls now contains over 12,000 people, whereas when the company commenced operations the entire ground in this district was covered with forest down to the water's edge, and was only frequented by lumbermen and Indians. The transmission lines of the company go in all directions, and supply power over a radius of 125 miles; at Three Rivers, on the St. Lawrence River, is the longest overhead crossing on the American Continent, this being a single span of 4,800 ft., with the cables suspended from steel towers 375 ft. high (fig. 2).

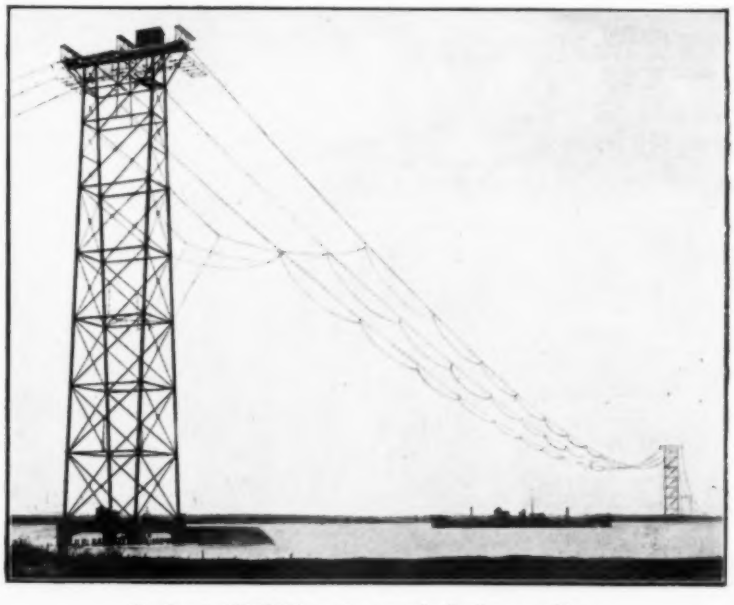

Fig. 2.—A 100,000-V crossing over the St. Lawrence River.

The total power generated and controlled by the Shawinigan Water & Power Company is 346,000 h.p., and the largest generating set is one of 45,000 h.p. which was put into service last year; but even this amount of power is not enough to supply the needs of the territory served by this company, and there is now under construction and approaching completion a large new power development at La Gabelle, on the St. Maurice River (see fig. 4). The length of the dam is 1,935 ft., and its greatest height above solid rock is 90 ft. The power house proper is 372 ft. long, 114 ft. wide, and 102 ft. high, while the sub-structure has approximately the same length and width, and is 110 ft. high.

The turbines, of which four are going in, with provision made for a fifth, are of the vertical type designed to give 30,000 h.p. each at 60 ft. head at a speed of 120 r.p.m. The generators are rated at 33,000 kVA each, and will supply 3-phase, 60-cycle current at 6,600 V. Each generator will have its own bank of three single-phase transformers, which in this case will have a capacity of 11,000 kVA each, and will step up the pressure to 66,000 V, and provision is made whereby, at some later date, the pressure may be raised to 110,000 V, all the equipment having been so designed

and built that this can be done when desired. As an indication of the ability and facilities of the large engineering firms of the country, it is interesting to note that the turbines, generators, transformers, and practically all the apparatus required are being built in Canada.

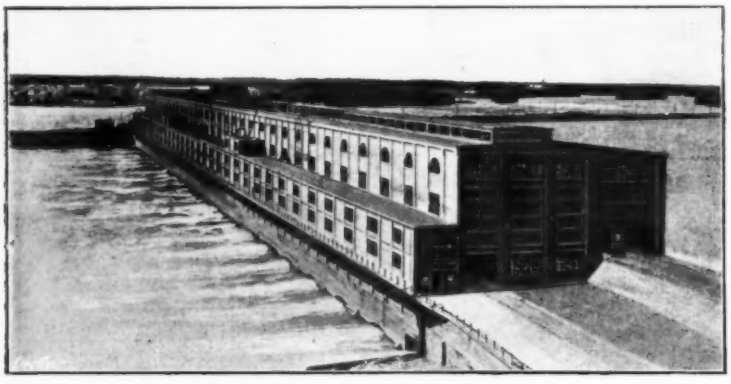

Fig. 3.—Exterior of the Cedars Power House.

half has already been completed. The policy of the Quebec Government is largely responsible for the successful operation of the great hydro-electric plants which have been constructed in that province. The Government has undertaken to regulate the flow of a number of the rivers from which power is being obtained, and to this end constructs dams and other regulating works. The largest dam is the "Gouin Dam," constructed in 1917; it is said to have created the largest artificial storage basin in the world. Having controlled the flow of water, the Government leases water rights to private companies, and charges rental for the water used, but leaves all development of power to the companies.

The Montreal Light, Heat and Power Consolidated controls and operates four hydro-electric stations, having a total capacity of 272,000 h.p., and buys 70,000 h.p. more from the Shawinigan Water and Power Company; there is also a steam reserve plant of 25,000 h.p. capacity. The peak load last year exceeded 263,000 h.p., and the load factor was 62 per cent. The company's customers include over 4,000 commercial and nearly 150,000 private consumers; of the former, the three largest are the Aluminium Company

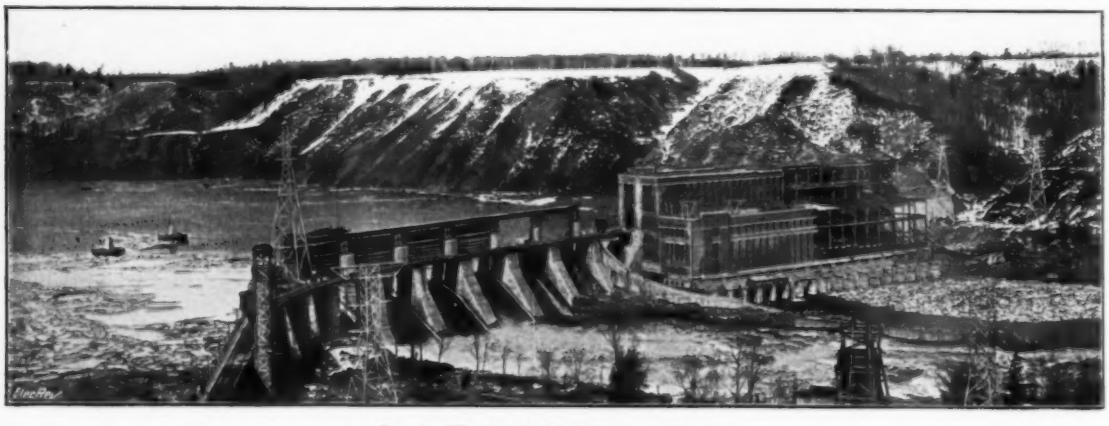

Fig. 4.—The La Gabelle Development, Quebec.

While the company supplies electrical energy to many cities, towns and villages for general purposes, about 55 per cent. of the total power supplied goes to large industries, among which may be cited the following:—The Canada Carbide Co., which finds markets for its products in all parts of the world; the Northern Aluminium Co., which has the largest electro-chemical establishment in Canada; the Belgo-Canadian Pulp and Paper Co., which turns out two hundred tons of newsprint daily and uses about 15,000 h.p.; the Canadian Electra Products Co., which manufactures acetaldehyde, acetic acid and its derivatives, in works covering over twenty acres of ground; the Canadian Aloxite Co., makers of aloxite, carborundum and ferro-silicon, taking more than 12,000 h.p.; the Shawinigan Electro-Metals Co., producing metallic magnesium and using about 1,500 h.p.; and the Canadian Ferro-Alloys, Ltd., which utilises more than 6,000 h.p. in the manufacture of its products. The total developments, present and future, of the Shawinigan Water & Power Co. will aggregate nearly 650,000 h.p., of which considerably more than one

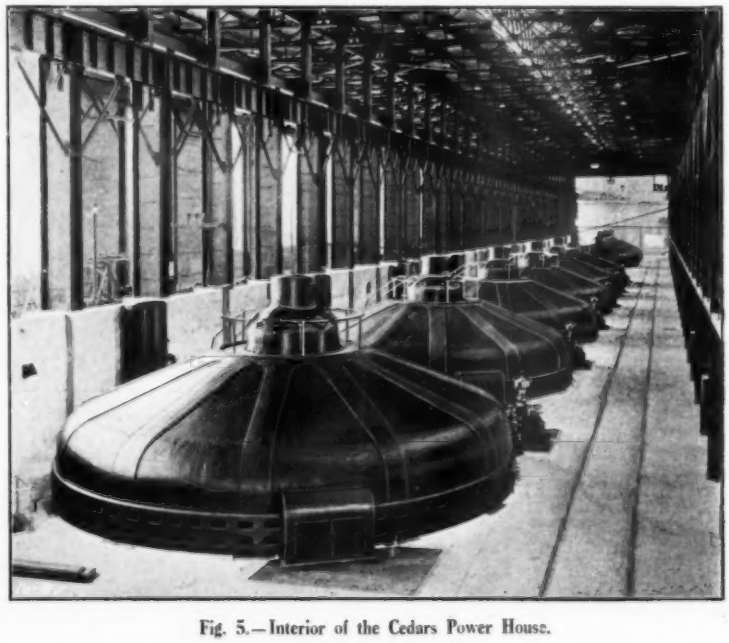

Fig. 5.—Interior of the Cedars Power House.

of America, the Montreal Tramways Company, and the Canada Cement Company, taking 75,000, 27,000 and 11,300 h.p. respectively. The company's Cedars plant is illustrated in figs. 3 and 5.

The Southern Canada Power Company, whose operations cover the eastern part of Quebec, is one that has acquired the properties of a number of smaller undertakings, including a few municipally-owned ones. The company transmits and distributes power over an area of 5,000 square miles; it has over 15,000 consumers, 270 miles of distribution lines, and about 300 miles of high-pressure transmission lines. Sixty-one municipalities get their supply of electricity from this company. The present capacity of the company's plant is 18,000 h.p., but a new development is now under construction, which will add 33,000 h.p. The system of customer ownership, which has been adopted within the last few years by a number of large electricity supply undertakings in the United States, was introduced into Canada by this company in 1922.

Some English Water Turbines.

Sir W. G. Armstrong Whitworth & Co.'s Products.

In an article in our issue of July 23rd, 1920, reference was made to the entry of Messrs. Sir W. G. Armstrong Whitworth & Co., Ltd., into the hydro-electric field, and some illustrations were reproduced of plant designed and manufactured by Messrs. Jensen and Dahl, of Christiania, to whose designs Sir W. G. Armstrong Whitworth & Co., Ltd., are at the present time working. In the last paragraph of that article we expressed the hope that it would not be long before we might be able to describe water turbine sets actually delivered by the Elswick firm.

The foundation of a hydro-electric department is naturally no easy task, and we were glad to see that at the general meeting of the company in June of last year Sir W. G. Armstrong Whitworth & Co.'s chairman, Sir Glynn H. West, in speaking of the firm's hydro-electric and civil engineering departments, was able to say that the policy of the directors in embarking upon what was at the time a new departure for the company had been so far amply justified.

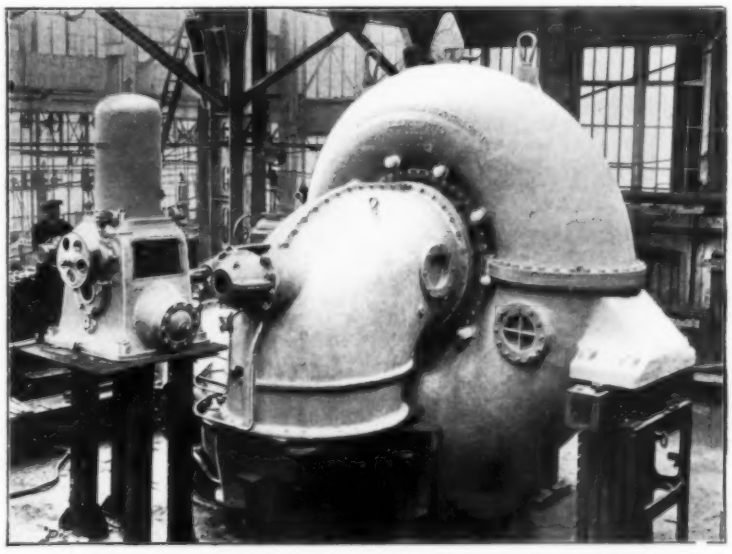

Fig. 1.—Armstrong Whitworth 14,000-h.p. Francis Turbine for the Humber River Paper Mills, Newfoundland.

The justice of this remark is well borne out by the plant under construction at the various works of the group of firms which are engaged upon the manufacture of the material required

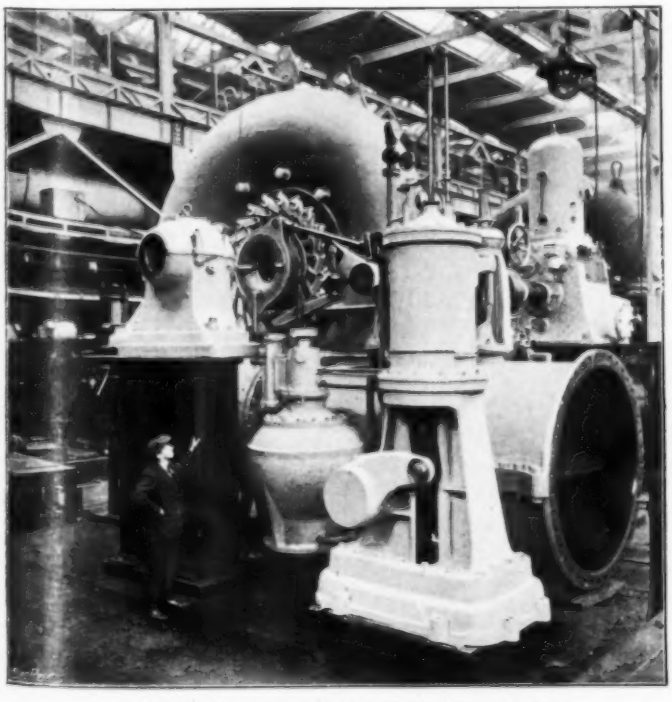

Fig. 2.—Alternator End of the Humber River Machine.

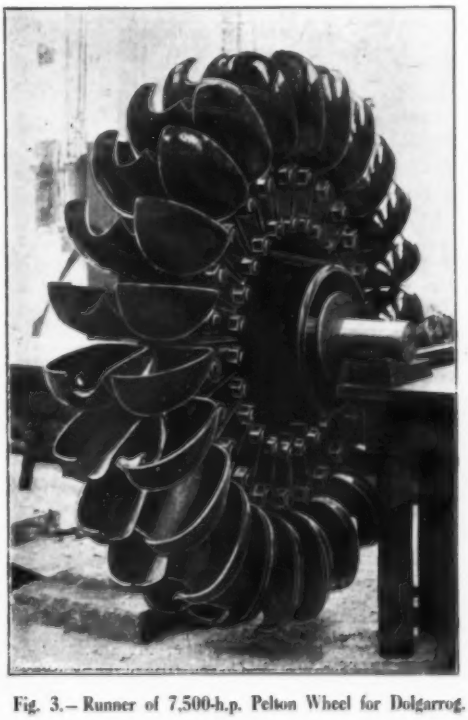

Fig. 3.—Runner of 7,500-h.p. Pelton Wheel for Dolgarrog.

in connection with hydro-electric work. At Elswick, water turbines are under construction totalling some 120,000 h.p.; at the Openshaw Works, Manchester, power house cranes; in the Armstrong shipyards, riveted steel pipe lines; at the works of the Armstrong Construction Co., Glasgow, structural steel for power houses, steel towers for overhead transmission lines, sluice gates for canals, intakes and forebays; at Warrington, at the works of Messrs. Pearson & Knowles, steel bands for wood stave pipe lines; and at the works of Messrs. Crompton & Co., Ltd., Chelmsford, electric generators. In the works at Elswick also, the drop stamping department has made the "shoes" for wood stave pipe lines; this is a new procedure in connection with this class of work, and an example of altered methods that may be adopted when a firm with Armstrong's resources takes up a new branch of engineering.

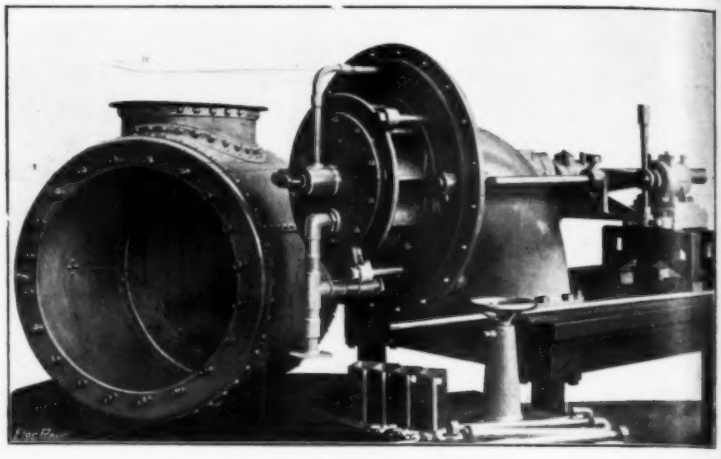

Fig. 6.—"Estate" Type Turbine.

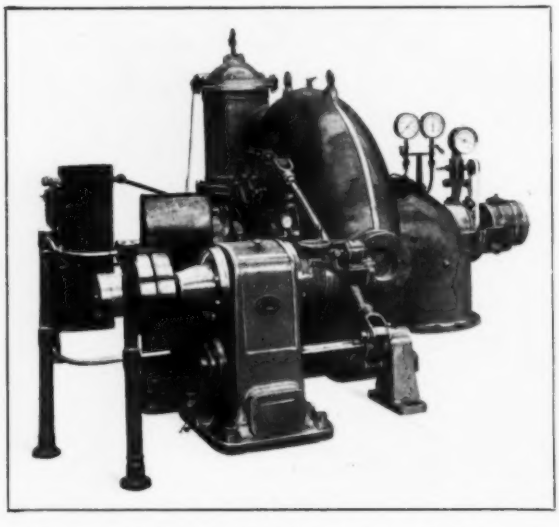

Fig. 4.—Turbine for Nymboida River Plant, N.S.W., of 660 h.p.

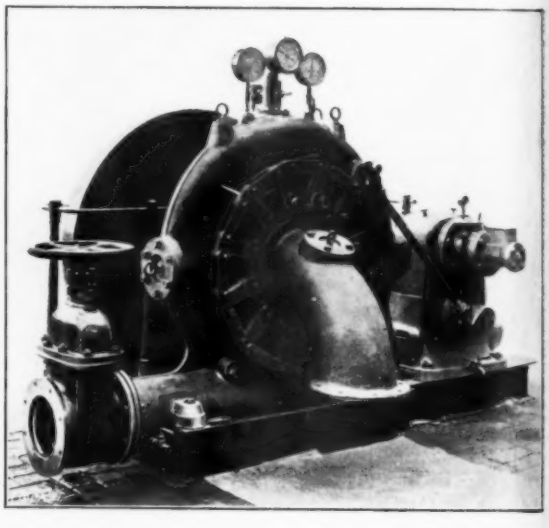

Fig. 7.—The first Armstrong Whitworth Turbine for Dorrigo, N.S.W.

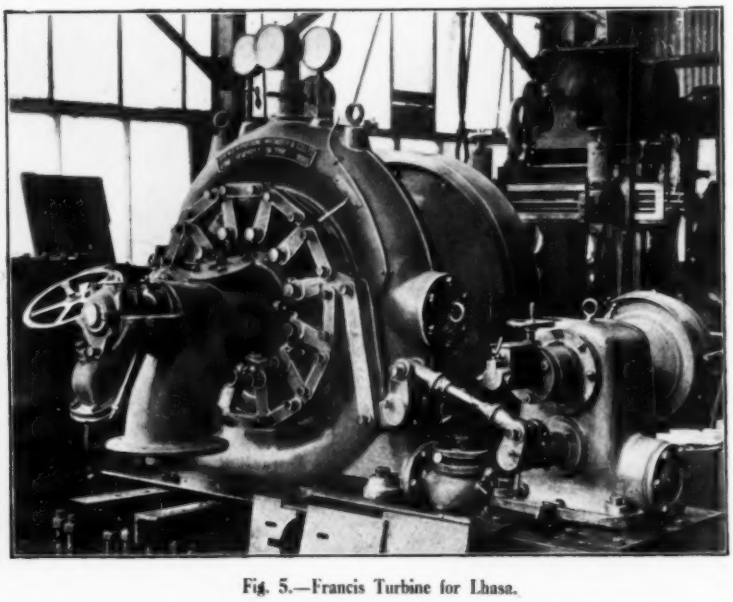

Fig. 5.—Francis Turbine for Lhasa.

As our readers are aware, Messrs. Sir W. G. Armstrong Whitworth & Co., Ltd., are now well advanced with the construction of a large hydro-electric plant in Newfoundland on the Humber river. This station will be used for the generation of power for a paper mill with an output of 400 tons of newsprint per day. The whole of the pulp and paper mill machinery is being constructed by their allied firm, Messrs. Charles Walmsley & Co., Ltd., of Bury, Lancs., who have supplied the paper-making machinery for most of our largest mills on the Thames and for the premier mills in Canada.

The illustrations which appear in this article will give some idea of the progress made by the company in water-power matters, with particular reference to the building of water turbines.

Figs. 1 and 2 are from photographs of one of the 14,000-h.p. spiral-casing Francis turbines for the Newfoundland contract. These turbines will work under a net head of 250 ft. and at a speed of 375 r.p.m., and from the point of view of dimensions they will be the largest spiral-cased horizontal Francis turbines ever manufactured in Great Britain. But for the abnormal length of the pipe lines, *i.e.*, 4,200 ft., these turbines would, of course, have been of the vertical type.

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one of the governors of the turbines for Newfoundland, which governors are being made in the Elswick works, and it is worth noting that all governors which will in future be supplied by the company with its water turbines will be made in Great Britain.

Fig. 3 is an illustration of a runner for one of two 7,500-h.p. Pelton wheels which have been delivered to the Aluminium Corporation at Dolgarrog.

Fig. 4 shows a small turbine which the company is manufacturing for New South Wales, where it is carrying out a complete contract for the supplying of power to the Grafton district, generated from the waters of the Nymboida river; the work covers all the civil engineering requirements, the manufacture and installation of the plant, and the construction of the transmission lines.

Fig. 5 shows a small Francis turbine for a power station at Lhasa; this will be the first electric plant installed in Thibet. Some particulars of the installation were given in our issue of October 17th.

Fig. 6 shows a small general purposes turbine of the makers' "Estate" type which is being delivered to a farmer in New South Wales for general farm purposes, saw mill, &c.

The first water turbine built by Messrs. Armstrong Whitworth since they inaugurated their hydro-electric department in 1920 is shown in fig. 7, which illustrates one of two 150-h.p. turbines installed at Dorrigo, New South Wales. As such, this plant is very interesting to those who watch the developments of British industry, and still more so to the advocates of the use of electricity in rural districts, as may be judged from the following paragraph which appeared in the *Industrial Australian and Mining Standard* of September 20th, 1923. It is a reference to the economy resultant from the use of hydro-electric power:—"Dorrigo butter factory, which recently installed a new plant connected up with the shire-owned hydro-electric plant, reports a saving of £1,200 a year over the old power and mode of lighting. The manufacturing cost of butter has been reduced by £2 0s. 6d. per ton."

We are informed that since the delivery of these two turbines for Dorrigo, the Elswick firm has delivered, or has received orders for, turbines totalling over 200,000 h.p.

Forthcoming Events.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, November 8th. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Paper on "Some Notes on Electrical Testing," by Mr. F. C. Knowles.

National Association of Supervising Electricians.—Tuesday, November 11th. At St. Bride's Institute, Ludgate Circus, E.C. (Private meeting for members only.) Lecture on the "New Regulations for the Electrical Equipment of Buildings," by Mr. J. M. Crowdy.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 10th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Research in the Cable Industry," to be opened by Mr. P. Dunsheath.

(North-Eastern Centre).—Monday, November 10th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Power Circuit Interference with Telegraphs and Telephones," by Mr. S. C. Bartholomew.

(North Midland Centre).—Tuesday, November 11th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Address by the chairman (Mr. T. B. Johnson).

(Scottish Centre).—Tuesday, November 11th. At 207, Bath Street, Glasgow. At 7.30 p.m. Address by the chairman (Mr. A. Lindsay).

(North-Western Centre, Students' Section).—Tuesday, November 11th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "Economics and Industrial Electrification," by Mr. A. Tustin.

(South Midland Centre).—Wednesday, November 12th. At the University, Birmingham. At 7 p.m. Discussion on "The New I.E.E. Wiring Regulations (Buildings)."

(Irish Centre, Dublin).—Thursday, November 13th. At Trinity College, Dublin. At 7.45 p.m. Discussion on "The New I.E.E. Wiring Regulations (Buildings)."

(Dundee Sub-Centre).—Thursday, November 13th. At the University College, Dundee. At 7.30 p.m. Paper on "Automatic and Semi-Automatic Mercury-Vapour Rectifier Sub-stations," by Mr. G. Rogers.

Women's Engineering Society.—Wednesday, November 12th. At 1, Upper Brook Street, W. At 4.30 p.m. To discuss the formation of a Women's Electrical Association.

Institution of Engineering Inspection.—Thursday, November 13th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 5.30 p.m. Paper on "The Development of Long- and Short-Wave Wireless Signalling," by Mr. A. P. Welch.

British Electrical Development Association.—SALESMANSHIP CONFERENCE.—Friday, November 14th. At the E.L.M.A. Lighting Demonstration Service Bureau, 15, Savoy Street, Strand, W.C.2. At 7.30 p.m. Paper on "A Programme for Intensive Lighting Development," by Mr. W. E. Bush.

Junior Institution of Engineers.—Friday, November 14th. At 39, Victoria Street, S.W. Annual general meeting.

Radio Exhibition and Wireless Convention.—November 15th to November 29th. At the White City, Shepherd's Bush, W.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

CLAYTON earthing clips.
REDGLO heaters (Martin's patent).

Notes.

Fatalities.—On October 27th an inquest was held at Doncaster upon the body of Laurence Turner (15), who was killed recently. A companion told the Coroner that he was with deceased when he heard him cry out. Witness turned round and found him with a wire, which carried current to a garage, in his hand. Deceased made a second exclamation and fell dead. The witness stated that he was responsible for the extension to the garage. After Turner's death he touched the wire and received only a slight shock. The electrical engineer of the Brodsworth Main Colliery said that the insulation of a part of the wire had perished, allowing the lead sheath to come into contact with the conductors. The pressure was 230-V; the wire should have been earthed, but this had not been done. In returning a verdict of "Accidental death," the Coroner spoke of the danger of inexperienced persons interfering with electrical extensions.

On October 29th Samuel Gibson, trailer, was killed at Risehow Colliery, Maryport. With a fellow trailer named Little he was trying to hoist a full tub and gripped the electric cable above him to steady himself. Little is suffering from shock. At an inquest on October 31st it was stated that upon examination a cut was discovered in the cable. A verdict of "Accidental death" was returned.

An inquest was held on November 3rd at Hackney on the body of W. H. Banks, aged 39, of Tollington Park, who died from heart failure as the result of an electric shock. The coroner, Dr. Edwin-Smith, in recording a verdict of "Accidental death," laid stress on the importance of trying artificial respiration in such cases.

Appointments Vacant.—Head of the engineering department of the Birmingham Municipal Technical College (£650); commercial assistant for the Willesden Urban District Council Electricity Department. Chief Assistant Engineer (£450) for the Rhondda Tramways Co., Ltd. (See our advertisement pages to-day.)

The Batti-Wallahs.—The Batti-Wallahs' Society will hold an informal meeting at the Engineers' Club on Wednesday, November 26th, at 8 p.m., when there will be what is described as a "mixed entertainment."

Educational.—MINING SCHOLARSHIP.—The Council of the Institute of Mining Engineers has accepted an offer by Messrs. Mavor and Coulson, Ltd., Glasgow, of £250 for one year for a post-graduate travelling scholarship. This is the first travelling scholarship in connection with the coal mining industry, and Messrs. Mavor & Coulson intend to offer annually a similar sum for the same purpose. The scholarship is open to British subjects over and under 21 years of age who are student members of the Institution of Mining Engineers, and who have graduated in mining at a university or college or taken the Associateship of the Royal School of Mines and have had at least twelve months' underground experience at a colliery.

Electrically-driven Ships' Auxiliaries.—The T.S.S. *Orama*, the first ship of the Orient Steam Navigation Co.'s new building programme, was delivered at Tilbury on October 25th, by the builders, Messrs. Vickers, Limited, after completion of her trials in the Irish Sea and on the Clyde. With the exception of the main feed and circulating pumps, the whole of the auxiliaries are electrically-driven, and some remarkable results in fuel economy constituting, we understand from the builders, a world's record, have been obtained. The contract provided for the fuel consumption at various powers being guaranteed by the builders, and the consumption during the two trials of 24 hours' duration were of special importance. The results obtained were, at 18.8 knots, 0.924 lb. per s.h.p. per hour, and at 14 knots 0.785 lb. per s.h.p. per hour. These figures, including as they do fuel consumption for all purposes, are remarkably low and are undoubtedly due to some extent to the extensive adoption of electrical auxiliaries and to superheated steam in the main turbines and the turbo-driven electric generators. The arrangement of the turbine installation is a novel one in merchant practice. There are three turbines, *i.e.*, h.p., i.p. and l.p., in series on each shaft, each turbine working through an independent pinion on the main gear wheel. Steam is supplied at 215 lb. per sq. in. working pressure, superheated to 544 deg. F. by 6 double-ended and 4 single-ended boilers working with Howden forced draught and burning oil fuel on the Wallsend-Howden system.

Local Societies.—MINING ENGINEERS.—At a meeting of the North of England branch of the Association of Mining Electrical Engineers held in Newcastle-on-Tyne on the 1st inst., a paper on the "Localisation of Cable Faults" was read by Mr. P. B. Addison, A.M.I.E.E., of the Newcastle Electric Supply Co.

PAISLEY ASSOCIATION.—Members of the Paisley Association of Electrical Engineers recently heard Engineer Rear-Admiral William Whittingham, C.B., lecture on the "Development of the Use of Electricity in the Navy." The president, Mr. J. M. Barbour, occupied the chair.

The lecturer gave an historical sketch of the methods employed in the early days of his career for the lighting and mechanical propulsion of all kinds of craft in the Navy, and of the advancement that has been made since, and explained at length the methods used in modern gunnery practice.

Electrical Trades Benevolent Institution.—The annual festival dinner will be held at the Trocadero Restaurant on Wednesday, November 19th, at 7.30. Mr. Dane Sinclair is the president of the festival. Tickets, price one guinea single, and 1½ guineas for a lady and gentleman, can be obtained from the hon. secretary, Mr. F. B. O. Hawes, M.I.E.E., 98, Grosvenor Road, London, S.W.1.

The sixth annual ball organised by the local Section of the E.T.B.I. is to be held in the Heaton Assembly Rooms, Newcastle-on-Tyne, on Friday, December 12th. The price will be 12s. 6d. each for single and £1 1s. each for double tickets, and the hon. dance secretary, Mr. A. K. Wardroper, c/o Callender's Cable & Construction Co., Ltd., Milburn House, Newcastle-on-Tyne, will be very pleased to receive applications.

Increasing Use of Automatic Sub-stations. — The reliability of automatic sub-stations has been very thoroughly demonstrated in the United States where the first equipment was installed about ten years ago, and the number now in service totals several hundreds. In this country the automatic operation of sub-stations is a much more recent development, but is receiving rapidly increasing attention. It is perhaps not generally recognised that while the actual number of such stations operating in this country is small, considerable numbers have been, and are being, built here. As an indication of this it may be stated that the British Thomson-Houston Co., Ltd., Rugby, has manufactured or has on order 41 automatic sub-station equipments totalling nearly 72,000 kW. for use in this country and overseas. The machines are either rotary converters or synchronous motor-generator sets according to the conditions to be fulfilled, and operate on supply frequencies of from 25 to 50 cycles, giving output pressures of from 400 to 3,000 volts d.c. Such plant is being used for electric traction, power, or mixed power and lighting loads; thus adaptability to every class of service is demonstrated. By the proper choice of size and location of the equipment the cost of feeders as well as operating charges may be reduced greatly, and at the same time the voltage regulation is improved.

Faraday House Old Students' Association.—On Friday last, the 16th annual dinner of the O.S.A. was held at the Hotel Cecil, the president, Mr. R. N. Vyvyan, M.I.E.E., engineer-in-chief of Marconi's Wireless Telegraph Co., Ltd., in the chair. There were present about 180 members and guests, including Mr. W. B. Woodhouse, president I.E.E., Sir John F. C. Snell, Mr. W. W. Lackie, C.B.E., Sir Charles Morgan, C.B.E., Sir James Devonshire, K.B.E., Sir Robert Hadfield, F.R.S., the Rt. Hon. F. G. Kellaway, P.C., Dr. Alexander Russell, F.R.S. (principal of Faraday House), and many other men distinguished in engineering and industry. After the loyal toasts, Mr. W. B. Woodhouse proposed "Faraday House and its Old Students," referring to the excellence of the system of training in force at Faraday House and the advantage of being under the tutelage of Dr. Russell, whose old students had gained distinction in all countries of the world. Dr. Russell, responding, was greeted with acclamation; he said that during the past year the test rooms and laboratories had been practically re-equipped, and 147 appointments had been gained by Old Faradians, largely in manufacturing, electricity supply, and cable works. Mr. C. P. Sparks, C.B.E., proposing "The Guests," referred to the new president of the I.E.E., Mr. Woodhouse, as being the "man of the moment" as he stood for private enterprise, and the results of the polls showed that the British working man also approved of private enterprise. He paid a tribute to the great work done by the Electricity Commissioners, whose report showed the stupendous progress that was being made. Sir Charles Morgan responded, alluding to benefits that they were now enjoying as the fruits of Faraday's researches; Sir John Snell, also responding, expressed his confidence in Faraday House, whose old students were missionaries of Empire, doing pioneering and civilising work inspired by the humanising as well as scientific influence of Dr. Russell. Mr. Kellaway, proposing "The Chairman," pointed out that engineers were always up against realities, and what the world wanted was men who faced realities and had no use for make-believe. Mr. Vyvyan responded, claiming that engineers played a great part in promoting the prosperity of the country, and urging that school education, like technical education, should be internationally standardised, so that a true international spirit should be created, based on sympathy and understanding. A musical programme during the dinner and a concert afterwards contributed to the success of a very enjoyable function.

Gas v. Electricity.—The severity of competition by electricity was referred to at some length by Mr. H. Clark, Superintendent of the Distribution and Gas Sales Department of the Derby Gas Co., in his address as President of the Midland Junior Gas Engineers at the opening of the 1924-25 session at Birmingham. Their competitors, both in electricity and oil, were, he said, specialising to eliminate gas. Tremendous inroads had already been made into the lighting load of gas; an attempt was now being made to capture the power load and the efforts to obtain a position in heating were not to be ignored. The plain fact was that they lived in an age when the "switch fever" was the chief factor—almost independent of the actual working cost—and whatever arguments were used against the extra cost, they were informed from all sides that the conveniences more than balanced or outweighed the additional outlay. It was apparent that the gas industry would be compelled to concentrate even more upon the maintenance of the power load, owing to the severity of competition. Speaking from long experience, he felt convinced that if they were to maintain and increase their power load, and to stand against all kinds of power competition, two definite actions must be taken:—*i.e.*, (1) Reduce the price of gas for engines over 20 normal b.h.p. to, say, 1s. 6d. per 1,000 cu. ft., or its therm equivalent, and (2) supply and fix gas engines on the hire system. They must fully realise that if they were to compete successfully they must make a considerable reduction in the price of gas; with town's gas at 1s. 6d. per 1,000 cu. ft., or its therm equivalent, the cost of power production equal to 1 kWh of electricity would be 0.44d., which figure was arrived at by taking the consumption of gas of a modern engine as 18 cu. ft. per b.h.p.-hour. With furnace oil in bulk at £5 per ton, the cost per b.h.p.-hour was approximately 0.27d., the consumption being 0.5 lb. per b.h.p.-hour. They must take into consideration the fact that the initial outlay on a crude-oil engine was about 20 per cent. higher than that for a town's gas engine and the depreciation was also much higher owing to the high compression pressures which must be maintained. Further, the attention required was considerably more. The cost of town's gas at the price suggested would be about 0.33d. per b.h.p.-hour. He suggested that the very low distribution costs in connection with the power load were not fully realised, such as four meter readings, four bills, and four checks per annum. Seven power consumers had used no less than 27,452,000 cu. ft. of gas during last year, and when they considered how much capital would have been spent on mains, services, cookers, &c., for the equivalent amount of gas to be consumed, they would full understand the necessity of reducing the price of gas to the lowest possible figure. The loss of a gas engine with its constant day load must be considered a setback to a gas undertaking.

In dealing with his second suggestion, he gave as a basis a 20-b.h.p. engine. The approximate cost of supplying and fixing it, including foundations, would be £160, to which sum £20 for interest and another £20 for depreciation and upkeep must be added, making a total of £200. Although the life of the engine would certainly be 15 years, he divided the £200 into 120 monthly payments of £1 13s. 4d. each, which was just over 8s. per week and covered a period of ten years, at the end of which time they would have re-imbursed themselves entirely for the outlay, including interest and depreciation.

Sooner than risk the possibility of losing the engine, it was far better to replace with an up-to-date engine on hire the old type of gas engine which had become inefficient and uneconomical; engines had been lost through lack of enterprise on the part of the industry. Up to a point the hire-purchase system had assisted them in their endeavours to retain the power load, but events during the last twelve months had revealed the fact that consumers were not prepared to spend capital on new plant when electric motors could be had on hire. He felt that if the hire system could be generally adopted gas engine makers would be glad to co-operate by extending the payment for new gas engines over a period of years.

Electrical Cloud Dispersion.—United States military pilots are experimenting in cloud-dispersal by aeroplane. According to the *Daily Mail* a container in the hull of each 'plane holds a quantity of electrified sand which is shot on the tops of clouds, evaporating the moisture within them and causing them to disperse. It is stated that recently several aircraft were able by this means to dissipate a bank of clouds, and that rain falls, and, in one instance, a small snowstorm, have been precipitated by aerial discharges of highly electrified sand.

Electric Ship Propulsion.—A new method of propelling ships electrically has been "invented" by Mr. Anton Flettner, the German director of the Institute of Aero- and Hydro-Dynamics at Amsterdam, and a successful trip has been made in the Baltic with a schooner fitted at Krupp's Germania Works at Kiel. In place of masts and sails are two metal cylinders or vanes as high as masts and three metres in diameter. The cylinders turn in the wind 100 times a minute, and have 15 times the effect of sails of equal size, for they generate electricity to serve a motor which in turn drives the screw. The research work took place at the Aero-Dynamic Institute at the University of Göttingen. The mechanism can be controlled by one man by electrical apparatus, and it is claimed that the cost of navigation will be reduced from 30 to 80 per cent.—*Daily Mail.*

A similar device was tried on the Seine some years ago, on a small scale.

Electric Furnaces in America.—Thirty-seven new electric furnaces were installed during 1923 in the United States and Canada, bringing the total number installed from 456 on January 1st, 1923, to 493 on January 1st, 1924. Of this number 442 are in the American industry and 51 in Canada. The new installations are mostly of small capacity, of five tons or less. Notable among the larger furnaces is one of 60-ton capacity. Development during the past year has been largely on the arc furnaces. Of the arc furnaces the three-phase, three-electrode, type seems to be operating the most satisfactorily. A number of repulsion-induction brass-melting furnaces was placed in commercial operation during the year; a notable accomplishment of this type of furnace was the successful melting of pure copper on a commercial basis. The largest horizontal single-ring type induction furnace in the United States has a maximum capacity of six tons, and in normal service will melt three tons every three hours. It requires 800 kW at 2,200 volts, single-phase, 8½ cycles, supplied from a specially-designed synchronous motor-generator. The motor of this set is rated at 1,400 kVA, 3-phase, and is operated at 80 per cent. leading power factor in order to compensate for low power-factor conditions in the electrical systems of the mill. In this way a low power rate is secured and the disadvantages of the inherent low power factor of induction furnaces are avoided.

According to a report just made public by the Department of the Interior through the Bureau of Mines, whereas in the United States there are about 540 active electric furnaces doing commercial non-ferrous melting, it is doubtful whether all foreign countries combined use 100 electric brass furnaces. Of the American furnaces, about 275 are induction furnaces, about 135 are moving indirect arc furnaces, 80 are Baily furnaces, while the remaining 50 furnaces are of various types. The Bureau of Mines declares that the growth is likely to continue, but no radically new type has been introduced in the United States in the last two years. The outstanding developments are the continued increase in the use of the induction and the rocking-arc types, and the lack of increase of less efficient types, such as the granular-resistor and the muffled-arc types. The popularity of the two chief types has been attained because both are efficient, both give lower metal losses than fuel-fired furnaces, and both stir the metal so as to give perfect mixing. The induction type is more or less standard for 24-hour operation in the rolling mill on yellow brass, and the rocking-arc type is more or less standard for red brass and for general foundry work. It is now generally accepted that no type or size of furnace which cannot melt red brass at 325 kWh per ton, or less, on 9-hour service under test conditions, or 375 kWh per ton or less under the handicap of ordinary foundry delays, is efficient enough to compete successfully with other types which will do this.—A.I.E.E. *Journal*.

Lightning Rods on Farms.—For more than thirty years the U.S. Weather Bureau has been an advocate of the protection of buildings and other property against lightning by suitable "rodding." The bureau is frequently called upon to advise inquirers concerning the proper methods and materials to be employed. Occasionally plans are drawn up in detail for the protection of Government structures, and in 1910 the White House was "rodded" according to specifications prepared by Prof. Marvin. To determine the relative liability of farm buildings to fire damage by lightning, a study of lightning fire losses was made recently by the Weather Bureau (Clip Sheet No. 326) of the United States Department of Agriculture. The average annual loss for the whole United States is a little over $12,000,000, which is probably a conservative figure. Illinois has the unenviable first place, with an average annual loss of over a million dollars, part of which may be attributed to industrial sections. Texas is next in order because of its large area and the presence of highly inflammable oil-storage tanks. New York is third, for reasons similar to those affecting Illinois. In the highly-developed agricultural states of the North heavy losses are suffered, especially through destructive cyclonic thunderstorms. If the index number showing relative liability of farm buildings to damage is small in one State when compared with another having equally destructive and frequent thunderstorms, it is quite probable that protection against lightning is more general in the former State. In Michigan, Wisconsin, Minnesota, and Iowa it is estimated that somewhat more than half of the farm buildings are protected.—*Journal* of the Franklin Institute.

Copper Which Bends One Way Only.—Copper bars that can be bent double with one finger, but require strength to straighten them again, which are really single crystals of pure copper, have been produced in the Research Laboratory of the General Electric Co. at Schenectady, N.Y. The usual piece of metal is a conglomeration of small, closely packed crystals; zinc, for instance, is a brittle metal, but a single crystal can be drawn out to six times its length in one direction; in another direction it is extremely brittle. A single crystal of copper seven-eighths of an inch in diameter and six inches long, as well as numerous smaller crystals of the same metal, have been produced by Dr. Wheeler P. Davey by a modification of the method devised by Dr. P. W. Bridgman, of Harvard University. Very gradual heating and cooling of pure copper in an electric furnace is the secret of success in producing them, and interesting results have been obtained. A large crystal about the size of a lead pencil, if given a jerking motion, bends as easily as does a stick of soft wax; it cannot be bent back, however, any more easily than a similar piece of ordinary copper. When the copper is a single crystal, all of the atoms are arranged in columns, equally spaced. When the bar is bent, the spacing is changed; the atoms on the inside curve are pressed together, and those on the outside are spread apart. Strains are set up and the crystal structure is altered; the bar becomes an ordinary piece of copper, of smaller crystals facing in all directions. If the surface of the large crystal is nicked or dented, the structure in the neighbourhood is changed in the same way. It is similarly affected by filing or polishing; when one of the bars is polished, it is necessary to take off a mil or less at a time. Even then the structure of the new surface is altered. The condition is remedied by etching away the surface with the usual acid bath. An etched bar of the copper appears to be rough; there seem to be alternate dark and light lines, due to the fact that the acid etches with the greatest difficulty parallel to the axes of the crystal. Externally, the large single copper crystals differ little from the usual metal.

The World's Largest Clock.—According to the *Electrical World*, electricity plays an important part in what is claimed to be the world's largest clock. This is the new clock of Colgate & Company, which takes the place of one that for many years has called attention to their Jersey City factory. The new clock, wound by a ¼-h.p. General Electric motor, rated at 110-V, 25 cycles, single-phase, has a dial diameter of 50 ft. The minute hand is 38 ft. 3 in. long and the hour hand 27 ft. 6 in., the hands weighing together 3,925 lb. More than two hundred lamps placed at regular distances around the hands make it as easy to tell the time by night as by day.

Meetings at the Club.—During this month 20 meetings will take place at the Engineers' Club, London, in connection with 16 different societies.

National Association of Supervising Electricians.—The Association's address is now:—Chalmers House, 43, Russell Square, W.C.1 (telephone, Museum 7024). This also applies to *Contact*, the official organ of the N.A.S.E.

Internal Competition in France.—As our readers are aware, the French electrical manufacturing industry has been largely developed in recent years. It is now reported that progress has been such as to bring about very severe competition amongst these concerns in their home market. One company, in reporting a loss of over 10,000,000 fr. for last year, attributes this to the "formidable competition which exists in this industry," the demand not yet being proportioned to the production, and to the fall in the franc, &c.

Institution Notes.

Institution of Electrical Engineers. — NORTH-EASTERN CENTRE.—The following is the programme of this Centre for the first half of the session:—

November 10th.—Mr. S. C. Bartholomew, on "Power Circuit Interference with Telegraphs and Telephones."
November 24th.—Messrs. S. W. Melsom, W. E. Beer, and H. C. Booth (joint paper), on "Current Rating of Single Conductor, Lead-covered Low-tension Cables" and "Current-carrying Capacity of Bare Copper and Aluminium Conductors."
December 8th.—Professor J. G. Gray's lecture on "Gyroscopic Pendulums."
December 17th.—Professor G. W. O. Howe's Faraday Lecture (open to the public) on "World-wide Radio Telegraphy."
January 12th, 1925.—Mr. G. Rogers, on "Automatic and Semi-automatic Rectifier Sub-Stations."

All of the meetings are to be held at the Armstrong College, Newcastle-on-Tyne, at 7.15 p.m., excepting that of December 17th, which takes place at 7.30 p.m. in the Lecture Hall of the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne.

SCOTTISH STUDENTS' SECTION.—Two papers have already been read this session, namely:—"Development of Electric Locomotives," by Mr. M. G. Say, and "Interlocked Multi-motor Electric Drives for Paper Machines," by Mr. S. A. Knight. The following are other fixtures for the session:—

November 21st.—"Electricity on Farms," by Mr. J. T. Allan.
December 12th.—"The Early Development of the Direct-current Dynamo and Motor," by Mr. B. Hague, A.M.I.E.E.
January 16th.—Address on "Domestic Uses of Electricity," by Dr. S. Parker Smith.
February 13th.—"Some Electrical and Physical Problems Affecting Long-range Radio Communication," by Mr. G. C. Colmar.
March 13th.—"High-tension Distribution," by Mr. F. E. Meade, A.M.I.E.E.

NORTH-WESTERN CENTRE.—The first meeting of this Centre was held on Tuesday last at the Midland Hotel, Manchester, when the chairman, Mr. H. C. Lamb, delivered his inaugural address. The following are some of the arrangements for the new session:—

November 18th.—At the Engineers' Club; informal meeting, discussion on "Wiring for Lighting, Heating and Domestic Services," introduced by Mr. W. A. Shaw.
December 5th.—At the College of Technology; popular lecture entitled "The Structure of Solids," by Professor W. L. Bragg, M.A., F.R.S.
December 16th.—At the Engineers' Club; paper on "Automatic and Semi-Automatic Rectifier Sub-stations," by Mr. G. Rogers, A.M.I.E.E.
January 6th, 1925.—At the Milton Hall; joint meeting with the Institution of Post Office Engineers; the Faraday lecture on "World Wide Radio Telegraphy," by Professor G. W. Osborn Howe, D.Sc.
January 20th.—At the Engineers' Club; paper on "Three-Wire D.C. Distribution Networks: Some Comparisons in Costs and Operation," by Mr. H. W. Taylor, A.M.I.E.E.
February 27th.—Annual dinner at the Midland Hotel.

INFORMAL MEETING.—The first informal meeting of the 1924-25 session was held on October 27th, when the President, Mr. W. B. Woodhouse, took the chair, and opened a discussion on the "Interconnection of Power Stations"; a keen debate ensued, in which seventeen speakers took part. Mr. Woodhouse made diagrams illustrating the unevenness of local conditions which might affect a station and the smoothing-out of these irregularities that might be obtained if interconnected stations were skilfully co-ordinated. He showed, too, what could be done by taking advantage of the diversity of load factor in the different parts of an area. On the question of protective devices, he thought the ordinary risks of interruption had been overcome. Agreements for interconnection were matters of quite easy adjustment, and might be made subject to periodical consideration in view of the use each connected station had made of the arrangement. They need not affect ownership of lines or the cost of interconnection.

Mr. H. M. Sayers said the time of steam raising was a consideration not always sufficiently recognised. He knew of stations of very good load factor with very poor stand-by efficiency, and advised a careful study of a time-table of known and predetermined loads. A real difficulty was that somebody must say which station should run and which shut down.

Mr. J. H. Sandiford spoke of the interconnection of three London systems without transformers in the lines, but they got over the difficulty by adding external reactance. Mr. A. G. Hilling also knew of stations satisfactorily interlinked by plain split conductors without transformers.

Mr. W. F. Andrews's experience of an interlinked system was that there was not the difficulty Mr. Sayers anticipated in obeying the mandate of the load dispatcher, nor was there any dispute over the cost of transferred loads.

Messrs. J. R. Bedford, F. E. Berry, W. Brooksbank, Dr. R. D. Gifford, V. N. Halliday, A. F. Harmer, R. V. Hook, T. R. Renfree, J. W. Robertson, W. E. Rogers, J. P. Shipley, A. J. Watts, and A. Williams also spoke, and Mr. Woodhouse replied.

MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—The address of the Chairman, Mr. H. H. Harrison, M.I.E.E., dealt with the art of communication engineering. It was illustrated with numerous lantern slides, and the author's aim was to picture the various means of telegraphing and telephoning at present employed, the latest developments being pointed out. He stated that the art was not only interesting, but it involved just as much engineering consideration as did the heavy branch, and concluded by stating that for many years to come it would offer to the young trained engineer an opening for his talents, and that it was not without its prizes too.

Junior Institution of Engineers.—On Friday last Mr. H. J. N. Riddle delivered a lecturette on "Audio-frequency Transformers." He said that these transformers were commonly used in telephone systems to compensate for long lines of high resistance, as well as in conjunction with thermionic valves for magnifying microphonic currents. A transformer had to deal with frequencies of from 14 to 40,000 cycles per second, all audible to the human ear, and the efficiency of the general type of transformer was by no means the same over the whole range. Some transformers responded more to high frequencies, others more to low frequencies. The design of a transformer to fulfil a certain purpose was always determined by experiment and not by calculation on paper, on account of the numerous factors which were concerned. Inductance, capacity, amount of wire, and size of wire were all variable and dependent on each other, and the value of the first two, at any rate, for a particular design could not be ascertained without actual experiment. The transformer should be designed also to suit the apparatus with which it was to be worked, and for wireless work especially very few pieces of apparatus had exactly the same characteristics.

Mr. Riddle demonstrated clearly the effect of eliminating high or low frequencies in a transformer by placing different capacities across the primary coil. The transformer used was of the "hedgehog" type, and was not what could be called a refined production, and yet proper adjustment to its surrounding apparatus, including the receiver, gave excellent results. The use of an ordinary telephone transformer for intervalve work was also successfully shown.

Royal Society of Arts.—The opening meeting, which was announced for Wednesday last, was postponed owing to Senator Marconi's inability to return from abroad in time. Next Wednesday Col. R. E. Crompton will read a paper on "The Motor-car, its Birth, its Present, and its Future," Mr. A. A. Campbell Swinton presiding. Mr. Ll. B. Atkinson will read his paper on "The Scientific Principles of Artificial Incubation" (announced here last week) on November 19th, while later evening arrangements include:—November 26th, Mr. C. F. Elwell on "Talking Motion Pictures"; and December 3rd, Prof. C. A. Carus Wilson on "The Teaching of Science in Secondary Schools." The Cantor Lectures (Mondays, at 8 p.m.) include three (January 19th and 26th, and February 2nd) by Mr. V. E. Pullen, of Woolwich, on "Radiological Research—A History"; and three (February 16th and 23rd, and March 2nd) by Dr. W. Rosenhain, on "The Inner Structure of Alloys." Three Howard Lectures are to be given in April and May, on "Motor Fuels," by Prof. J. S. S. Brame. The papers, &c., for after Christmas include the Trueman Wood Lecture by Sir E. Rutherford; Sir J. Fortescue Flannery on "The Diesel Engine in Navigation"; Sir Dugald Clerk (subject later); Maj.-Gen. Sir W. Sefton Brancker on "Commercial Aviation"; Dr. J. S. Owens on "Modern Atmospheric Conditions"; Mr. C. A. Baker on "The Electrical Equipment of the London County Hall"; Lord Blyth on "Penny Postage and Postal Communications Generally"; and Lord Stevenson on "The British Empire Exhibition."

Electrical Power Engineers' Association.—The following lecture arrangements have been made for the Southern Division and the Manchester Section, respectively:—Southern Division—To-night, Friday, at 7 p.m., lecture by Mr. J. N. Waite on "Combustion and Boiler House Efficiency"; December 5th, lecture by Mr. B. Samuels on "Boiler Efficiency"; January 2nd, lecture by Mr. F. W. Berry on "Transformer Design." All at I.E.E. Building, London. Manchester Section—Thursday, November 27th, lecture on "The Localisation of High- and Low-pressure Cable Faults," by Mr. P. B. Addison; Thursday, December 11th, lecture on "The Impulse Steam Turbine," by Mr. S. M. S. Sichel (Metropolitan-Vickers Electrical Co.). Both at 7.15 p.m., at the Geographical Hall, Deansgate, Manchester.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Mr. HARRY BAILEY, late of the Wandsworth Electrical Manufacturing Co., Ltd., London, has joined the staff of Messrs. Falk, Stadelmann & Co., Ltd., as outdoor representative, and will operate in the Midlands.

Mr. E. BROWN, consumers' engineer in Portsmouth Corporation Electricity Supply Department, has been appointed consumers' engineer in the electricity department of the Southampton Corporation. Mr. A. H. WATSON, mains assistant, has been promoted to be consumers' engineer at Portsmouth, and Messrs. G. V. THARLE, of Blandford, and R. C. CALDBECK, of Barrow-in-Furness, have been appointed mains assistants.

Mr. J. KIRKHAM has joined the board of Messrs. Rawlings Bros., Ltd., as joint managing director with Mr. W. R. Rawlings, in the place of Mr. J. J. Rawlings, who will continue to act in an advisory capacity. Mr. Kirkham has been secretary of the company for many years; his place is taken by his assistant, Mr. A. R. Murrell. A dinner was held to mark the changes on October 24th.

Mr. A. R. PICKETT has been appointed general manager of Crompton & Co., Ltd., for Sydney and Melbourne.

The *Electrical World* reports that Mr. C. E. SKINNER's name has been put forward for the position of president of the American Institute of Electrical Engineers for the 1925-26 session. Mr. Skinner is assistant director of engineering with the Westinghouse Electric & Manufacturing Co.

Mr. R. H. CAMPION, M.I.E.E., has resigned his position as manager of the Chesterfield Corporation Electricity and Tramways Departments, to take up an appointment with a power company in London.

In connection with the General Election our readers will probably remember, when considering the factors which were at work in the fight against Socialism, that Mr. H. E. BLAIN seven months ago left the "Underground" to become principal agent at the Unionist Central Offices. In that short time he effected important changes, and the National Unionist Association was reconstituted on a new basis, giving every district adequate representation on the Central Council, and also providing for the inclusion of wage-earners both in local and central committees.

The Times states that Professor ANDREW ROBERTSON has been appointed principal of Bristol Merchant Venturers' Technical College, in succession to the late Dr. Wertheimer. Prof. Robertson received most of his training at Manchester University, and he was appointed Demonstrator in Engineering there. Five years ago he became Professor of Mechanical Engineering in Bristol University.

At a meeting of Armstrong College Council, Newcastle, on November 3rd, Mr. J. A. WILKEN, B.Sc., Ph.D., was appointed Lecturer in Electrical Engineering. Dr. Wilken is a graduate of the Universities of Copenhagen and Buenos Aires, and has been engaged in the United States and Argentina. Recently he has been Lecturer in Mathematics at Sunderland Technical College.

The Industrial Australian reports that Mr. F. T. M. KISSEL has been appointed chief electrical engineer to the New Zealand Government in succession to the late Mr. Lawrence Birks.

Mr. J. K. A. NICHOLSON, engineer-in-charge of the Plymouth relay station of the British Broadcasting Co., who has been promoted to be engineer-in-charge of the Newcastle main station, was on Saturday, at a gathering of the entire staff attached to the Plymouth station, presented with a silver cigarette case.

The East Ham Town Council has fixed the salary of the new electrical engineer and manager, Mr. W. R. ELLIOTT, at £650 per annum, as from July 1st last, rising by annual increments of £50 to a maximum of £750, plus the full cost of living bonus.

Mr. T. B. JOHNSON, M.I.E.E., the new chairman of the North-Midland Centre of the Institution of Electrical Engineers, which meets at Leeds, entered the Post Office at Hull in the year 1885. Four years later he was transferred to the Engineering Department, Newcastle-on-Tyne. He received his training under the late Mr. A. W. Heaviside, and at the Armstrong College. In 1892 he was appointed an engineer in the second class, and was placed in charge of the Newcastle West Section, which included the Newcastle Telephone Exchange (the only multiple exchange belonging to the Post Office). In 1895 he took a leading part in the transfer of the National Telephone Co.'s trunk system in Newcastle and district to the Post Office. Late in 1899 he was promoted to a first-class engineership in London, where the Post Office was about to start the telephoning of London, and he served in the Survey and Telephone Sections. He received the appointment of technical officer in 1903. Two years later, when the Engineer-in-Chief's Construction Section was formed, he was transferred to be the first assistant under Mr. A. Moir. In 1907 Mr. Johnson became assistant superintending engineer of the Northern District at Newcastle, and late in 1911 he was promoted to be superintending engineer of the North-Eastern District, with headquarters at Leeds. He transferred the National Telephone Co.'s system in the North-Eastern District to the Post Office on January 1st, 1912. During the war he was largely employed in the provision of telephone and telegraph facilities for military and naval works, including the fitting up of aerodromes, training camps, anti-aircraft arrangements (for which Leeds was the centre of the country north of the Wash), and the laying of "civilian" cables in and near the Humber. In 1918 the Leeds Automatic Exchange—the largest in Europe, and the largest system in the world to be transferred from one system to another—was completed (under considerable difficulties owing to the war), and opened by the Rt. Hon. A. H. Illingworth, then the Postmaster-General. Mr. Johnson has always been a zealous advocate of the automatic telephone, especially since the success of the Leeds Exchange proved its suitability for large cities. An automatic exchange has since been opened at Grimsby, and one at York to take the subscribers for the whole city. Another is in course of construction at Harrogate, and one will be installed at Halifax as soon as the extension of the Post Office building is completed. The Leeds suburban exchanges are now being converted to automatic working. Others are contemplated at Wakefield, Keighley, and other places. Since his appointment as superintending engineer at Leeds he has been largely engaged on the laying of the underground cables, and the taking down of overhead routes. The Leeds-Hull cable opened in 1914 was the first "balanced" cable to be laid in the country, and its success was followed by the general laying of such cables. Mr. Johnson will deliver his inaugural address to the North-Midland Centre on November 11th.

Scrimshaw] **Mr. T. B. Johnson, M.I.E.E.,** *[Leeds.*
Chairman of the North-Midland Centre of the Institution of Electrical Engineers.

Mr. DOUGLAS H. BISHOP, B.Sc., general manager and engineer of the Dundee Corporation Electricity Department, is the new chairman of the Dundee Sub-Centre of the Institution of Electrical Engineers. He delivered his opening address on October 16th. Mr. Bishop was educated at Queen Mary's School, Walsall, and, after obtaining a scholarship, entered the Mason University College, Birmingham, where he was awarded the first and second year scholarships in Science, the Senior Engineering Diploma, and a Bowen Scholarship for original research in electrotechnics, and subsequently the degree of B.Sc. in Engineering. Afterwards he went to Messrs. Bellias & Morcom, Birmingham, for industrial workshop experience. In December, 1901, he started in Dundee as a switchboard attendant. After receiving training in all the departments under Major H. Richardson, M.I.E.E., he was engaged in 1907-9 on the plans and installation of plant for the then new e.h.p. generating station at Carolina Port. He was head of the generating department until Major Richardson resigned in October, 1922, when he received his present appointment.

Mr. D. H. Bishop, B.Sc.,
Chairman of the Dundee Centre of the Institution of Electrical Engineers.

Mr. M. M. GILLESPIE, of Messrs. Gillespie & Beales, London, who has for many years represented the interests of Messrs. Browett, Lindley & Co., of Manchester, has been appointed a director of the company, and he will attend to that company's business as heretofore at the same address, Amberley House, Norfolk Street, W.C.

Mr. A. M. PATON, chairman of the Tees-Side Sub-Centre of the Institution of Electrical Engineers, commenced his career at Prince Alfred College, Adelaide, South Australia. In 1896 he proceeded to the University of Adelaide, whence he graduated in 1898 with the degree of B.Sc. with honours in mathematics and physics. From 1899 to 1901 he was at Cambridge, where he took the B.A. degree with honours in the mechanical sciences tripos, after being awarded an exhibition and foundation scholarship at St. John's College.

His first commercial appointment was with the Westinghouse Electric & Manufacturing Co., Pittsburgh, U.S.A., where he passed through the various departments, leaving in 1902 to join the British Westinghouse Co., for which he carried out electrical designing, estimating, the preparation of tenders, &c., for a period of three years. In 1905 and 1906 he acted as supervisor in the Royal Carriage Department of Woolwich Arsenal, being engaged upon ordnance mechanical work, &c. From 1906 to 1912 Mr. Paton was with the Cleveland and Durham Electric Power Co., Ltd. Here he acted as general engineer of the Company's Consumers' Department, and prepared schemes for the electrification of iron, steel, and general engineering works, rolling mills, shipyards, flour and sugar mills, &c., as well as supervising the installation of these schemes. Mr. Paton paid two visits to the Continent for the company to study electrical developments, particularly with regard to large rolling mills. In 1911 he was elected an associate member of the Institution of Civil Engineers. After short periods at a Bradford electric smelting works and at the Rugby works of the British Thomson-Houston Co.,

Ltd., Mr. Paton commenced practising as a consulting engineer in 1917. Since that time he has advised and supervised in connection with a number of important electrical and mechanical installations on the North-East Coast. Most of this work has been shipyard equipment, but the list also includes installations at a cement works, rolling mills, a foundry, &c.

Elliott & Fry] [*London.*

Mr. A. M. Paton, B.A., B.Sc.,
Chairman of the Tees-Side Sub-Centre of the I.E.E.

Mr. Paton has been a corporate member of the I.E.E. for five years.

Mr. GLOVER, who was recently appointed tramways manager at St. Helens, has resigned owing to his acceptance of a position at Hong Kong. Mr. Bellamy, whom Mr. Glover succeeded, also went to Hong Kong.

The New Parliament.—The following gentlemen connected with electrical affairs were successful candidates at the General Election:—Sir PHILIP DAWSON (Lewisham); Mr. G. BALFOUR (Hampstead) (of Balfour, Beatty & Co.); Sir FREDK. HALL (Camberwell) (a director of the City of London Electric Lighting Co., Ltd.); Sir G. HUME, M.I.E.E. (Greenwich) (late chairman of the Highways Committee of the L.C.C.); Sir NEWTON MOORE (Richmond) (a director of the General Electric Co., Ltd.); Mr. W. PRESTON (Walsall) (head of W. Sanders & Co., Wednesbury); and Mr. J. B. BURMAN (Duddeston, Birmingham) (of Birmingham Electricity Committee).

Sir A. STEEL MAITLAND, who again represents Erdington, Birmingham, resigned in 1919 from the post of Director-General of the Department of Overseas Trade. Mr. H. G. WILLIAMS (Reading) is the secretary and manager of the Machine Tools Trade Association. Captain G. K. PETO (Frome) is a managing director of the Morgan Crucible Co., Ltd. Mr. T. OAKLEY (Wrekin) is an electrician. Sir W. BULL (South Hammersmith) is a director of Messrs. Siemens Bros. and Co., Ltd., of Woolwich.

Obituary.—DR. W. BOVERI.—We regret to learn that Dr. Walter Boveri, president of Messrs. Brown, Boveri & Co., and one of the original founders of the company, died at his home in Baden on October 25th, after an illness of some duration.

MR. D. W. HOOD.—*The Times* records the death, at the age of 50 years, of Mr. David Wilson Hood, C.B.E., M.Inst.C.E., who has been a specialist in electrical, optical, and acoustical science in connection with lighthouse engineering in the Corporation of Trinity House, the service of which he entered at the age of 21 years. During the war he rendered very special service in the coastal lighting plans for these islands, and he was an acknowledged authority on optical science as applied to lighthouse illumination.

MR. P. B. DELANY.—The *Electrical World* records the death, which occurred on October 19th, at his home at Orange, N.J., at the age of 80 years, of Mr. Patrick Bernard Delany. For 50 years Delany was an associate of T. A. Edison. He left Ireland, the land of his birth, at an early age, went to America, and learned telegraphy in Hartford, Conn., subsequently engaging in newspaper work. "His greatest achievements were in the field of telegraphic invention, and he had to his credit 150 successful patents, the result of his untiring efforts in the laboratories he maintained in Nantucket, Mass., and South Orange. Mr. Delany was the recipient of the Elliott Cresson gold medal twice and of the John Scott legacy medal of the Franklin Institute, of which he was a member. He was also a member and a former vice-president (1893-95) of the American Institute of Electrical Engineers."

MR. C. O. BASTIAN.—We regret to record that Mr. Charles Orme Bastian, M.I.E.E., passed away on October 29th, at the age of 55 years, after an illness of six weeks. Mr. Bastian was the eldest son of the late Dr. Charlton Bastian, M.D., F.R.S. He was educated at University College School and University College. He specialised in electrical engineering and worked for a time with Messrs. Crompton & Co., Ltd. The deceased had a great inventive genius and patented many improvements especially connected with the use of radiant heat. He was a pioneer of modern methods of electric heating and the inventor of the Bastian water heater and thermal storage geyser. He was a frequent contributor to the electrical Press, as readers of our "Correspondence" columns, in particular, will remember. Mr. Bastian's only son, Stanley, was killed in the Great War in 1915. The funeral, which took place at Golders Green Crematorium on Monday last, was attended by Surgeon-Commander William Bastian and Mr. James Bastian, brothers, Dr. William Hill, cousin, Lieutenant-Commander F. J. Campbell Allen, partner of the firm of Bastian & Allen, Mr. Samuel Landman, and representatives of the staff and workpeople of the Bastian Meter Co. and of Messrs. Bastian and Allen.

MR. J. S. HADWELL.—The death took place on October 25th, of Mr. Joseph Stenson Hadwell, who was on the staff of the British Thomson-Houston Co., Ltd., at Rugby. He was formerly in business as an electrical engineer at Leicester.

Will.—The late Mr. W. H. TWEEDY, of the Eastern Telegraph Co., left £5,505 gross and £5,245 net personalty.

New Companies Registered.

Kingsmill Art Metal and Electrical Co., Ltd. (201,236).—Registered October 24th. Capital, £5,000 in £1 shares. To acquire the business of a manufacturer of metal work in iron and bronze carried on by J. B. King at 142b, Fulham Road, S.W.10, as the Kingsmill Art Metal and Electrical Co. and to carry on the same and the business of repoussé work, damascene work in gold and silver, reproductions and period work, electrical fittings, carved gilt wood and carton pierre fittings, door, fire and window furniture, switch plates, installations, &c. The subscribers (each with one share) are:—E. Allen, 16, Eastcheap, E.C., solicitor; W. H. Dunne, 57, Lodge Road, Croydon, C.A. The subscribers are to appoint the first directors. Qualification, £100. Remuneration, £25 each per annum, free of income tax. Solicitors: Allen, Edwards and Oldfield, 16, Eastcheap, E.C.3. Registered office: 142b, Fulham Road, S.W.10.

Electric Screen Wipers, Ltd. (201,227).—Private company. Registered October 24th. Capital, £4,000 in £1 shares. To adopt an agreement with W. H. Melmore and Fluid Pressure Pumps, Ltd., and to carry on in the U.K. or elsewhere the business of manufacturers of electric windscreens and glass wipers, electrical, mechanical, galvanic and optical appliances, accessories for motor cars, builders and manufacturers of motor cars, &c. The permanent directors are: C. A. Davis, Amberley House, Norfolk Street, Strand, W.C., solicitor; W. M. Melmore, Clifton Street Works, Notting Hill, W.; J. T. Mears, 5, Hill Street, Richmond; G. H. Smart, Clifton Street Works, Notting Hill, W. Qualification, £100. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, Strand, W.C.2. Registered office: Clifton Street Works, Notting Hill, W.

J. W. Leek, Ltd. (201,302).—Private company. Registered October 27th. Capital, £1,000 in £1 shares (600 7½ per cent. cumulative preference). To acquire any lands and buildings in Lancashire, Cheshire and Derbyshire or elsewhere, to lay out land for building purposes, and to carry on the business of an electric light company, &c. The subscribers (each with one share) are:—J. W. Lock, The Bungalow, Washway Road, Sale, electrical engineer; C. E. Rogerson, 26, Linley Road, Sale, Cheshire. The subscribers are to appoint the first directors. Qualification, 100 ordinary shares. Secretary (*pro. tem.*): C. E. Rogerson. Solicitor: P. H. Barker, 1, Princess Street, Manchester.

Ino Guarantee Lamp Co., Ltd. (201,290).—Private company. Registered October 27th. Capital, £100 in £1 shares. To carry on the business of general merchants and factors (wholesale and retail) in electric lamps, wireless valves, electrical accessories, &c. The first directors are:—J. Harrison, 44, St. Mary's Road, Prittlewell, Southend-on-Sea, merchant; C. K. Milsom, 37, Britannia Road, Westcliff-on-Sea, merchant. Qualification, 50 shares.

Potteries Radio Co., Ltd. (201,304).—Private company. Registered October 27th. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of, agents for and dealers in instruments, apparatus, accessories and materials of all kinds, capable of being used in connection with radio or wireless telegraphy, &c. The permanent directors are:—H. W. Richards, address not stated; E. P. Richards, address not stated; N. L. Richards, Maitlands, Chapel-en-le-Frith, Derbyshire, radio components salesman; J. Haigh, Bunfield House, Chapel-en-le-Frith, radio components salesman. Qualification, £100 shares. Solicitor: F. Whittaker, 12-16, Booth Street, Manchester.

Horley and District Electricity Co., Ltd. (201,415).—Registered October 31st. Capital, £20,000 in £1 shares. To adopt an agreement with C. R. St. John and Partners, and to carry on the business of an electric light company in all its branches. Minimum cash subscription £10,000. The directors are:—R. L. Norris, Newstead Hall, Horley, county councillor; W. H. Batchellor, Station Road, Horley; J. J. Chiswell, Greenfields, Horley; C. G. Selfe, The Corner House, Horley; J. H. Robinson, Violetta, Horley; A. C. Rowson, Stoneycroft, Horley; R. C. Sanceau, Rokesly, Horley. Qualification, £200. Remuneration as fixed by the company. Secretary: H. H. S. Ross. Solicitor: H. H. S. Ross, Horley, Surrey. Registered office: Lloyd's Bank Chambers, Station Road, Horley, Surrey.

Trent Electric Wire Works, Ltd. (201,383).—Private company. Registered October 30th. Capital, £2,500 in £1 shares. To acquire the business of a manufacturer of insulated wire carried on by C. Cook as the "Trent Electric Wire Works" at Shardlow. The subscribers (each with one share) are:—C. Cook, Millfield, Shardlow, engineer; G. Buxton, Holly Villa, Shardlow, gentleman. The subscribers are to appoint the first directors. Qualification, 100 shares. Remuneration as fixed by the company. Secretary: G. Buxton. Solicitors: Starkie and Lowis, Castle Donington and Long Eaton. Registered office: The Wharf, Shardlow, Derby.

Park Royal Engineering Co., Ltd. (201,293).—Private company. Registered October 27th. Capital, £30,000 in £1 shares. To acquire the business of electrical engineers carried on by the Park Royal Engineering Works, Ltd. (in liquidation), together with all or any of the assets thereof, and to adopt an agreement with Sir Henry C. Holder, Bt., and C. C. Brinton. The subscribers (each with one share) are:—J. L. Nicholson, 25, Walpole Street, Chelsea, S.W.3, engineer; F. E. Francis, 314, Stoney Lane, Smethwick, Staffs., clerk. The first directors are: Sir Henry C. Holder, Bt., C. C. Brinton, C. E. Lloyd, and J. L. Nicholson. Registered office: Cumberland Avenue, Park Royal, N.W.10.

Official Returns of Electrical Companies.

Mechanical Ads, Ltd.—A. C. Vincent, F.S.A.A., of 13, Queen Street, E.C., was appointed receiver and manager on October 22nd under powers contained in debentures dated March 21st, 1924.

F. and A. Parkinson, Ltd—Mortgage on certain properties in Guisdey, dated October 2nd, 1924, to secure all moneys due or to become due from the company to the Bank of Liverpool and Martins, Ltd.

Isle of Wight Electric Light & Power Co., Ltd. (53,823).—Return dated May 9th, 1924. Capital, £150,000 in 20,000 ordinary and 10,000 preference shares of £5 each. All shares taken up. £150,000 paid. Mortgages and charges, £83,748.

W. Lucy & Co., Ltd. (51,908).—Return dated March 21st, 1924. Capital, £15,000 in £10 shares (350 preference and 1,250 ordinary). 250 preference and 1,080 ordinary taken up. £10,810 paid on 250 preference and 831 ordinary. £2,490 considered as paid on 249 ordinary. Mortgages and charges, nil.

Atlas Wireless Co., Ltd.—Particulars filed of £1,500 debentures authorised August 25th, 1924, constituting a floating charge on the whole of the company's undertaking and assets, the amount of present issue being £1,250.

Bull Motors, Ltd.—Particulars filed of £15,000 debentures authorised October 15th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Pickvance, Ltd.—Issue on October 11th, 1924, of £100 debentures, part of a series already registered.

Power and Traction Finance Company (Poland), Ltd.—Amended particulars of Trust Deed.—The trust deed dated October 1st, 1924, securing £1,250,000 5 per cent. guaranteed debenture stock 1924-44, constitutes, in addition to the fixed charge on specific assets originally registered, a general charge on the company's undertaking and property, present and future, including uncalled capital.

"Ceag" Miners Supply Co., Ltd. (138,208).—Return dated June 16th, 1924. Capital, £10,000 in £1 shares (9,000 ordinary and 1,000 preference). 8,804 ordinary shares taken up. £8,804 paid. Mortgages and charges, nil.

La Plata Electric Tramways Co., Ltd. (101,431).—Return dated July 2nd, 1924. Capital, £450,000 in £1 shares (200,000 preference and 250,000 ordinary). All shares taken up. £170,007 paid on 170,007 preference shares. £279,993 considered as paid on 29,993 preference and 250,000 ordinary shares. Mortgages and charges, £113,190.

City Notes.

Victoria Falls and Transvaal Power Co., Ltd.

At December 31st, 1923, the issued share capital of the company amounted to £3,000,000 and the outstanding debentures to £2,719,670. After providing for interest and premium on debentures (£145,637) and for depreciation, income tax, &c. (£428,241), there remains a balance of £294,190—net profit for the year. To this is added £91,546 brought forward, making £385,736. The directors have transferred £50,000 to reserve. Dividends aggregating 10 per cent. on the preference and ordinary shares, paid during the year, absorbed £230,642, leaving a balance of £105,094 to be carried forward.

After protracted negotiations, commenced last year, with representatives of the mining groups, arrangements were recently concluded for supplies of power for a period of 20 years or longer. The new contracts date from January 1st, 1923. The prices for compressed air and steam remain unchanged, and those for electricity, whilst showing a substantial reduction to consumers commensurate with the increased size of the business since the former power contracts were entered into, are at the same time satisfactory to the company and have been approved by the Electricity Control Board. Further, during the negotiations, advantage was taken of the experience gained during the continuance of the former power contracts to settle satisfactorily all outstanding matters between the mining groups and the Rand Mines Power Supply Co., Ltd., and the Victoria Falls company up to the end of 1922. The new contracts provide for all supplies being given directly by the Victoria Falls company and not partly by the Rand Mines Power Supply Co., Ltd., as in the past.

A satisfactory arrangement has also been entered into with the Electricity Supply Commission and approved by the Electricity Control Board, under which the company is constructing, on behalf of the Commission, a large power station at Witbank (situated about 60 miles north-east of Brakpan), in which district the Commission is applying for a licence to sell power. This station will in the first place be operated by the company. The arrangement provides that the company may take from the new station at cost price the entire output apart from that required for the Commission's other consumers. The company and the Commission have agreed to co-operate in every way in the establishment and working of the Witbank station. This arrangement will enable the company to meet the growing requirements of its consumers and to provide adequate spare plant. The meeting is to be held in London on November 13th.

French Companies.

The *Société de l'Energie Electrique du Nord de la France* proposes to increase its capital from 48,057,000 to 50,000,000 fr.

The *Société des Constructions Electriques*, of Nancy, has just declared a dividend for 1923-24 at the rate of 44 fr. net per old share and 38.50 fr. net on the new capital.

The accounts of the *Société Le Fil Dynamo*, of Lyons, show net profits amounting to 437,000 fr. for 1923-24, the balance forward rendering 604,000 fr. available for disposal. It is proposed to pay a dividend at the rate of 16 fr. per ordinary share.

The *Société de la Maison Breguet* reports that in the case of the electrical branch of the undertaking, owing to the keen competition between makers in France and the low selling prices, it has restricted its activity in this respect to the manufacture of special machines.

Italian Companies.

The *Società Friulana de Elettricità (Udine)* has decided to increase its capital from 3,500,000 to 4,200,000 lire by raising the value of its shares from 250 to 300 lire, 700,000 lire being taken from the extraordinary reserve for the purpose. Following this operation, the capital will be advanced to 7,500,000 lire by the issue of 11,000 300-lire shares, 5,760 representing the compensation for the assets of the Società Elettrica del Barman and the Società Idroelettrica del Friuli Centrale, absorbed by the Società Friulana.

By the issue of 10,000 100-lire new shares, the *Società Bergamasca*, of Bergamo, has increased its capital from 20,000,000 to 30,000,000 lire.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Aldershot Gas, Water, and District Lighting Co.—£60,000 new 4 per cent. consolidated preference stock, partly and fully paid.

Adelaide Electric Supply Co.—250,000 new 6½ per cent. "C" cumulative preference shares of £1 each, partly paid and fully paid, Nos. 250,001 to 500,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Ayrshire Electricity Board.—Scrip, fully and partly paid, for £750,000 Ayrshire (Local Authorities) Electricity 4½ per cent. redeemable stock, 1945-1955.

Brisbane Tramway Trust.—Scrip, fully and partly paid, for £1,500,000 5½ per cent. inscribed stock, 1944-1954.

Melbourne and Metropolitan Tramways Board.—Scrip, fully and partly paid, for £700,000 5 per cent. stock, 1944.

Companies to be Struck off the Register.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Leeds Battery Co., Ltd.
Regent Electrical Installation Co., Ltd.
Select-o-Phone, Ltd.
Thermophone Co., Ltd.

French Companies.—The *Société de l'Energie Electrique du Nord de la France* proposes to increase its capital from 48,057,000 to 50,000,000 fr.

Lisbon Electric Tramways, Ltd.—After deducting a debit balance brought forward, debenture service, and directors' remuneration, the balance for 1923 was £25,066; this is to be carried forward. The number of passengers carried rose from 75,862,877 to 89,566,215, the system having operated throughout the year without serious interruption. The fall of the exchange hampered the company during the latter half of the year.

Parsons Foreign Patents Co., Ltd.—The following dividends have been declared:—No. 12, 5 per cent., and 8.2d. per share, less tax, at 1s. 2½d. in the pound; and No. 13, 3s. 8d. per share, less tax, at 4s. 6d. in the pound.

Parsons Marine Steam Turbine Co., Ltd.—The directors recommend a dividend at the rate of 7 per cent., free of tax, out of profits amounting to £16,372, plus £30,156 brought forward. A balance of £30,682 is carried to next account.

Belgian Companies.—The following Belgian companies are making large additions to their capital:—Société Bruxelloise d'Electricité, from 7 to 15 million fr.; Les Exploitations Electriques, from 18 to 25 millions; Compagnie Belge d'Exploitations Electriques, from 1,050,000 to 1,700,000 fr.; and the Outillage et Machines-Outils Blavier, from 1,000,000 to 1,500,000 fr.

Castner-Kellner Alkali Co., Ltd.—The profit for the year ended September 30th was £288,052. The directors recommend a final dividend of 14 per cent. (making 22 per cent. for the year); £75,000 is transferred to suspense account; and £22,087 carried forward.

German Company.—The *Schleswig-Holsteinische Elektrizitats Verband*, of Rendsberg, is making an issue of 8 per cent. debentures to the extent of 600,000 gold marks which are being offered at 80 per cent.

City of Buenos Ayres Tramways Co. (1904), Ltd.—Dividend for quarter ended September 30th at the rate of 5 per cent. (1s. 3d. per share).

Cawnpore Electric Supply Corporation, Ltd.—An interim dividend of 3 per cent. has been declared on the ordinary shares as in 1923.

Ever-Ready Co. (Great Britain), Ltd.—Dividend at the rate of 10 per cent. upon both the preference and ordinary shares for the half-year ended September 30th.

Aron Electricity Meter, Ltd.—Dividend of 3 per cent. on the preference shares, bringing payment of arrears up to September 30th, 1923.

Delabole Cornwall Electric Light Co.—At the annual meeting, held on October 27th, Mr. S. Radcliffe presiding, a balance of £100 was carried forward.

Hart Accumulator Co., Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares.

Stanton Ironworks Co., Ltd.—Interim dividend of 4 per cent. actual, free of tax.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have been forging ahead in all directions as a result of the General Election. The remarkable success of the Unionist Party at the polls came as a complete surprise. It stimulated substantial buying, and this, in its turn, revealed the shortage of stock that prevails in many of the industrial sections. Upon this scarcity of supply we have commented on many, perhaps too many, previous occasions, but the previous insistence upon this point will enable readers to obtain a better understanding now of the extraordinary way in which cable stocks, for instance, have gone ahead, and electricity supply shares have advanced. Certainly a great deal of actual buying has taken place during the past few business days, and, with the general atmosphere exhilarated by the prospect of a stable government being in power for the next few years, even the former sellers withdrew their orders. Buyers who flocked into the markets found that they had to pay distinctly higher prices, some of the marking-up being almost automatic—before any stock changed hands.

The electricity supply group shows a catalogue of rises. In this department, particular satisfaction is felt with the result of the Election, owing to the expectation that Parliament will now pass, without demur, the two Electricity Bills promoted by the London groups. Such legislation would place the electricity supply industry upon a firmer basis than it has experienced for years past. Investors have come in to buy the shares on this consideration, and the quotations were advanced promptly all along the line. Bournemouth & Poole have had another somewhat spectacular rise, being quoted at 57s. 6d. for the old shares and 56s. 6d. for the new issue. They are both getting fairly close to the 60s. at which rumour reported, some time ago, when the price was nearer 2½, that the shares were to be acquired by the Bournemouth Corporation, a rumour which, as we showed at the time, was not credited in every quarter. In the London shares, County ordinary have risen 3s. to 2½, making 5s. in a fortnight. Westminsters at 10⅞ put on 7s. 6d., Metropolitans at 1 13/32 are 3s. 9d. up, and others have advanced similarly. Going further afield, Melbourne ordinary is 2 points higher at 155½, and Midland Counties ordinary 6d. better at 22s. Isle of Thanet preference advanced to 7, the ordinary shares remaining about £4 per share, though it is expected that the latter will improve as soon as they are split into £1 shares, when, on the basis of the existing price, they will be quoted at about 16s.

The cable list shows some of the most striking rises of the week, Eastern ordinary at 172½ being 7 higher, on the top of the rise of 4 points which occurred last week. Eastern Extensions gained 10s. and Westerns at 16½ are equally better. Globe ordinary at 17½ are ⅜ up. Great Northerns advanced 15s. to 30½. Both the Anglo-American stocks have risen. Jobbers in this department frankly confess that they have not been eager to deal, except as buyers, because they had little stock on their books, and, as soon as this was taken, they did not know where to go for more. Chili Telephones at 5 9/16 are up 1/16, and, in the wireless group, Marconis, after touching 37s. 6d., reacted a trifle to 36s. Canadian Marconis, the subject of a fairly general tip during the past week, strengthened to 8s. 6d., at which price a few sellers came in.

Not only the cable stocks, but cable manufacturing shares are buoyant. Henleys, Callenders and Siemens have all gone ahead. Amongst electrical manufacturing issues, rises have lifted English Electrics, General Electric ordinary and the company's "B" preference. Metropolitan-Vickers ordinary spurted to 25s. 6d., on the securing by the company of an important new contract. Johnson & Phillips rose to 27s. There is a marked scarcity of shares in this department as well as in that for the cable and electricity supply issues. India-Rubber preference strengthened to 16s. 3d.

Amongst railway stocks, Metropolitan District spurted 3 to 53, but Metropolitans, after a jump to 78½, went back to 77, still showing a rise of 10s. on the week. The latter stock is amongst the very few which gave way when the full effect of the General Election made itself felt throughout the Stock Exchange markets. Stock Exchange opinion assumes that if the Wembley Exhibition is not re-opened next year, the Metropolitan may suffer considerably, in spite of the fact that the company is now absorbing into its regular service a good many of the trains that were put on, in the first instance, for the special purpose of serving the Exhibition. British Electric Traction ordinary is better at 95½ and London transport shares are steady, without showing any special movement.

Brazilian Tractions are 2 higher at 58. The Mexican Utility group holds its prices without showing further advances on the week. Anglo-Argentine Tramways 5 per cent. debenture is up to 75½ and deserves to stand higher.

Amongst engineering shares, Babcock & Wilcox have put on 2s. 3d., at 49s. 3d. Vickers went up to 12s., before reacting a shade. The rubber share market is handling an unusually extensive volume of trade. Selective supply companies serving the City should be gainers by the "midnight oil" which will be consumed in this week's heavy Stock Exchange settlement. Physical effects of the public's new-found appetite for stocks and shares find reflection in the reluctant necessity for curtailing, for sheer lack of time, the comments upon the interesting items that, at the moment, abound. It means strenuous work to be a member of the Stock Exchange in a Unionist boom.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Nov. 3, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	36.3	—	*£3 10 4
Charing Cross Ordinary	1	14	14½	2⅝	+3/-	6 12 5
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 3 10
Chelsea	1	10	12	37.6	+ ⅛	6 6 0
City of London	1	15	15	42/3	+ ½	6 9 10
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 2 3
County of London	1	10	15	2½	+ ⅛	6 0 0
do. do. 6 % Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	8	7	7	6½	—	3 17 0
do. 6 % Pref.	5	6	6	5½	—	5 9 1
Kensington Ordinary	5	12	14	9⅝	+ ½	7 5 5
London Electric	1	10	10	20/6	+6d.	6 13 4
do. do. 6 % Pref. ...	5	6	6	6½	—	5 14 3
Metropolitan	1	8½	10	1⅛	+ ⅛	5 10 4
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	2½	6	1	—	6 0 0
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	23/-	—	5 12 6
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	19/3	—	4 4 8
do 6 % Pref. ...	1	6	6	19/6xd	—	6 3 1
St. James' and Pall Mall ...	5	14½	17½	12½	—	7 4 5
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Westminster Ordinary	5	12	15	10⅞	+ ⅜	7 4 7
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/-	—	7 18 0

HOME RAILS.

Central London Ord. Assented Stock	4	4	70½	+ ½	5 14 2
Metropolitan ... ... ,,	8½	4	77	+ ½	5 4 0
do. District ... ... ,,	3	3½	53	+3	6 12 1
Underground Electric Ordinary	10	Nil	Nil	2⅛	+ ⅛	Nu
do. do. "A" ...	1	Nil	Nil	8/-	—	Nil
do. do. Income Bonds	5	5	90	+2	*6 1 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	104	+1	5 15 6
do. Def.	,,	1½	1½	24½	+ ½	6 3 9
Chili Telephone	5	6	6	5 9/16	+ 1/16	5 8 1
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	17	+ ⅛	5 17 8
Eastern Tel. Ord.	Stock	10	10	172½	+7	5 16 0
Globe Tel. and T. Ord.	10	10	10	17½	+ ⅜	5 14 3
do. do. Pref.	10	6	6	11¼	—	5 6 8
Great Northern Tel.	10	24	25	30½	+ ⅜	7 5 8
Indo-European	25	7	7	23½	+ ½	*5 6 1
Marconi	1	15	10	36/-	+1/6	5 11 3
Oriental Telephone Ord.... ...	1	12	12	15xd	+ ⅛	*6 8 0
United R. Plate Tel.	5	8	8	6 1/2	—	*5 17 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	+ ½	6 1 3

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref....	8	12½	8½	8⅞	—	8 6 0
do. do. 2nd Pref. ...	5	5½	6	9⅞	—	9 8 2
do. do. 5% Deb. ...	Stock	5	5	75½	+1	6 13 5
British Electric Traction Ord. ...	,,	5	5	95½	+1	6 5 8
do. do 6% Pref. ...	,,	6	6	102½	—	5 18 3
Brazil Traction	100	4	4	58	+2	6 18 0
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	90/-	86½	—	*5 13 6
do. do. Deferred	,,	8	129/5	108½	—	*5 19 0
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	8/-	—	6 5 0
London United Tram. Deb. ...	Stock	4	4	55½	—	7 4 2
Mexico Trams. 5% Bonds ...	—	Nil	5	78	—	6 8 4
do 6% Bonds ...	—	Nil	Nil	65	—	Nil
Mexican Light Common ...	100	Nil	Nil	28	—	Nil
do. Pref.	100	Nil	Nil	47½	—	Nil
do. 1st Bonds ...	—	5	5	67	—	7 9 3

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	49/3xd	+2/3	*4 17 6
British Aluminium Ord.... ...	1	*5	5	24/3	+9d.	4 1 8
British Insulated Ord.	1	15	15	56/3	—	5 6 9
Callenders	1	15	15	58 9xd	+ ⅛	5 2 0
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅞	—	8 17 10
Edison-Swan	4/-	7½	—	6/-	—	5 0 0
do. ,, 5% Deb.	Stock	5	5	71½	—	6 19 10
Electric Construction	1	10	10	13	—	7 5 6
English Electric	1	8	5	17/9	+1/-	5 11 9
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	22/3	—	5 15 10
do. Ord.	1	5	5	21/-	+1/-	4 13 3
Henley	1	15	15	58/9	+ ½	5 2 0
do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	16/3	—	*6 3 1
Met.-Vickers Pref....	3	6	6	25	—	6 14 9
Siemens Ord.	1	5	—	1½	+ ⅛	4 9 0
Telegraph Con.	12	20	20	26	+1	*4 13 3

*Dividends paid free of Income Tax.

Power Transmission Lines: Aspects of their Design.—V.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.Am.I.E.E.

(*Concluded from page* 648.)

In certain Colonies some allowance should be made for the ravages of termites (white ants). The writer has had occasion to examine wooden poles which have, in a very short space of time, been almost totally destroyed by the work of ants and a species of wood insect (the carpenter ant). Some species of ants live partially on the wood, but they dig out the wood with their powerful mandibles. Impregnation by means of creosote and other coal-tar preparations is of little value, as the insects usually return after a time to finish their work. In such countries, too often the failure of a line during wind storms has proved conclusively that, due to deterioration of the timber wrought by ants, materials other than wood must be used for line supports.

In computing the total overall height or length of a line support it would seem better to take:

(*a*) The minimum height of conductors allowed by law;

(*b*) + the allowance for sag at the maximum summer temperature for the largest size of conductor used at the same or at the lowest point of support;

(*c*) + the practical *total* vertical separation of conductors, which amount is dependent upon the number of cross-arms, line voltage, sag, arrangement, and size of conductors;

(*d*) + the vertical distance between the upper cross-arm and the top of line support;

(*e*) + the depth set or buried (deeper for the latter condition) in the ground.

The sum total of (*a*) to (*e*) inclusive gives the *total* overall length of line support, but, as an insulator and part of a pin* form part of the height, they must be included, and this difference should be subtracted from the total length, which gives the net length of line support required. In cases where upward vertical gusts of wind (as in ravines) and where the wind pressure has a downward component (tending to increase the sag due to the added weight on the conductors), an allowance should be made in (*c*).

When a line is supported by flexible poles, and sometimes "A" frames, it is the practice to place stays at about every tenth pole along straight runs, but nearly always at roads and other crossings, depending upon the length and position and importance of the crossing. Stayed poles should be larger (unless allowance has already been made in the design) than those in the remainder of the line, or the adjacent spans should be shortened. Stays should be placed at the point of resultant load, that is to say, the stay should be attached to the line support as near as practicable to the centre of the conductor load to be sustained, *i.e.*, at or near the transverse component point. Stays should be kept pulled up tight, as the staying of a wood pole is its real strength; but they should not be tightened so as to carry any considerable initial stress, as such a condition may throw an unnecessary initial load upon the pole. A tightening-bow should preferably be used for adjusting the tension. The approximate stress in a stay wire at a terminal or "*dead*" end can be obtained from the expression: $(T/\sin\phi)$, but at an angle in the line the stress is expressed $(R/\sin\phi)$; wherein R is the resultant load in lb. to be balanced; T is the total terminal end load due to conductors, in lb.; $\sin\phi$ is the sine of the vertical angle between the stay and line support. The vertical stress in a pole due to a stay is expressed: $(g\cos\phi)$; wherein g is stress in lb., and $\cos\phi$ is the cosine of the vertical angle between the stay and pole. Struts are not much used; to determine their size it is usually found sufficient to assume the load as a compression stress. An approximate expression for the working load in lb. on a strut is $(800\ d^4) \div (l)^2$; wherein d is mean diameter of strut in ft. and l is the length of strut in feet. Pole stays should be made of $\frac{1}{2}$ or 5/16th inch galvanised-steel stranded wire.

The overhead earth wire affords a certain protection to line insulators. It does not, however, afford any appreciable protection to wooden poles in addition to that given where individual earthing wires are installed on each pole, except possibly in regions where earthing conditions are exceptionally poor. The extra wire increases the wind and ice loading on the line, and may require a larger size of pole than would otherwise be used. For example, if a single three-phase circuit is to be constructed, the addition of an earth wire above the power wires, which is the proper location for an earth wire, will increase the transverse pole load about 30 per cent., and therefore if an ample allowance in design of the pole was not originally made, a larger size pole may be required or the span lengths may have to be decreased, which, in turn, will increase the cost of the line. Placing the earth wire below the power wires may not cause an increase in cost, but the same degree of protection is not secured. For a single three-phase pole line, the writer would, for this country in particular, and for most lines, recommend the installation of a larger insulator at the top of the pole (top of the delta arrangement of line conductors) in place of the overhead earth wire construction. Where the overhead earth wire is used, steel wire and not copper cable should be erected.*

When the route of a proposed line has been surveyed and a drawing of route prepared—showing the effective obstacles requiring change in direction of line, as also the effective parts requiring longer line supports than ordinarily required and caused by normal topography and location, &c.—and when the size of conductors and the span lengths have been determined, the selection of line supports having the required transverse strength for the different loadings (due to the span, the loading, and the height of points of support) can then be computed. For any given line, the writer considers it more practical to work out a series of calculations for different span lengths and/or different conductor arrangements and conductors of different sizes where the point or points of application of load above the ground are changed, also for the greatest sag, the highest temperature, and the least heavy conductor (if two or more different sizes of conductors are used). Such a series, if plotted, will show at a glance the most desirable field data for the different spans, the length, size, and strength of line supports required, as also the sag to allow for the respective span lengths and different temperature, &c. Also, in those cases where an approximate fixed length of span is used throughout the line, there is an advantage in working up a series of computations for several other span lengths—longer and shorter—because they assist in placing a check on the calculations thus made and also to show the most

*The height of line insulators varies with makers' types. The height of conductors above the cross-arms for pin-type insulators, in feet, is approximately 0.5 for 11,000 volts; 0.7 for 22,000 volts; 0.9 for 33,000 volts; 1.1 for 44,000 volts; and 1.3 for 66,000 volts.

*The copper cable has several disadvantages, especially in regions subjected to half ice conductor loading, as copper cable collects sleet, and experience seems to prove that steel wire will not collect as much.

suitable set of conditions to adopt for the given spans, as also a selection of the best spans.

As an illustration, let us take the case of a line requiring wooden "A" frames varying in length from 30 ft. to 45 ft., due to the different spans which the survey data show to be necessary.

Problem.—It is required to erect a line carrying one No. 1/0 L.S.G. bare hard-drawn copper wire fixed on top of the "A" frame, and two No. 1/0 L.S.G. bare hard-drawn copper wires on a cross-arm which is placed at the "*minimum allowable*" distance below. The system is three-phase and the circuit voltage is 33,000 volts between any two of the three line conductors at the generating end. The line is located principally across country in a district where ½-in. thickness of ice and 8.0 lb. of wind can be expected. According to the survey notes, the following different span lengths of line supports have been mapped out:—200, 250, 300, 350, 400, and 450 ft. respectively, the locations for which are clearly marked on the field map of the route, which is practically level. Find the size and the lengths of wood "A" frames, using *round* poles.

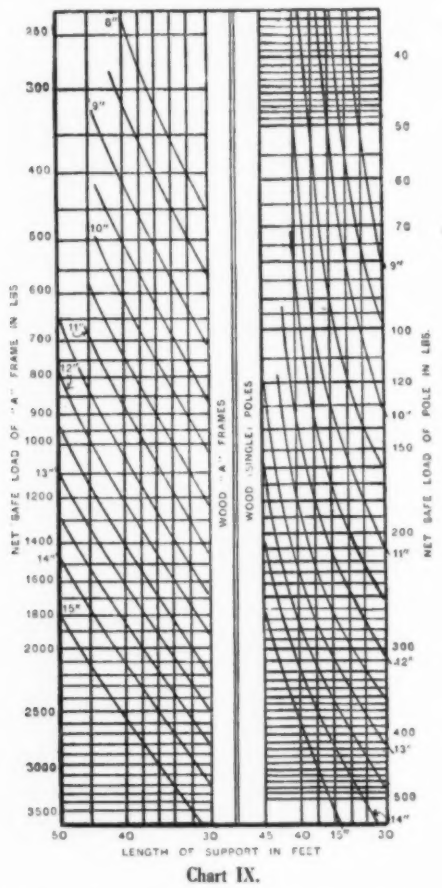

Chart IX.

In making calculations for the length and size of line supports for level and straight runs it is sufficient to take account of the maximum wind pressure which may be exerted on the line conductors and the pressure due to the wind on each line support, both acting horizontal and at right angle to the direction of line. The moment due to the pressure on the pole is not included in this text for the reason that the nearest larger standard size should always be chosen; the *total* moment due to the pressure on the conductors is the only pressure considered. Usually 10 per cent. addition will suffice for the gross total bending moment. From Chart V we find this load on the conductor (No. 1/0 L.S.G.) to be 0.88 lb. per lineal ft., hence the total transverse load for a 200-ft. span is $3 \times 0.88 \times 200 = 528$ lb., or a value slightly less than the net safe transverse load strength of pole or "A" frame required.

The estimated length of "A" frame for a 200-ft. span is—

Minimum height established by law ...	20 ft.
Allowance for sag at 120 deg. F. (see Chart VI*)	2.6 ,,
Vertical separation of conductor for sag of 2.6 ft. and pressure of 33,000 volts (see formula 9 and table I)	2.6 ,,
Pole buried in ground	5.5 ,,
	30.7 ft.
Less height of insulator-pin above cross-arm	0.9 ,,
Estimated height of pole required ...	29.8 ft.

The nearest stock size of "A" frame recommended is 30.0 ft. in length.

The total resisting moment for this length of frame, due to the load and arrangement of the line conductors, is—

$$200 \times [(1 \times .88 \times 24.5) + (2 \times .88 \times 21.9)] = 12{,}000 \text{ lb.-ft.}$$

Assuming that this load is applied at a point 2.0 ft. below the top of the "A" frame set 5.5 ft. in the ground, the net safe transverse load is $12{,}000/(30-7.5) = 534$ lb. As this condition shows a greater resisting moment and will carry the load with the required factor of safety, the nearest larger figure for net safe transverse load strength of pole required will do. Chart IX shows the diameter of a 30-ft. "A" frame to be 8.5 in. To carry the same load on a 30-ft. *single* wood pole, conforming with the required standards, would require a pole 14 in. in diameter (see Chart IX); such sized poles are not so plentiful, nor is the timber from which they are taken.

Calculated results for the remaining spans are given in the following tabular form:—

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	Span length.
20	3'0	2'8	5'5	0'9	30'3	32	16,300	686	665	9	250
20	6'0	3'0	6'0	0'9	34'1	34	20,590	820	800	10	300
20	8'0	3'2	6'0	0'9	36'3	36	25,750	969	920	11	350
20	10'5	3'6	6'0	0'9	39'3	40	33,360	1,097	1,043	11'5	400
20	13'5	3'9	6'5	0'9	43'0	45	42,650	1,230	1,170	13	450

wherein—

a = minimum height allowed by law, in ft.
b = allowance for sag of conductor at 120 deg. F. (see Chart VI*), in ft.
c = vertical distance between conductors (see formula 9a†), in ft.
d = depth set in ground, in ft.
e = height of insulator-pin above cross-arm, in ft.
f = estimated length of pole required, in ft.
g = nearest standard or stock length of frame, in ft.
h = total resisting moment due to load, in lb.-ft.
i = net safe transverse load strength, in lb., for load applied as given in example.
j = ditto, for load applied 2.0 ft. below top of pole (see Chart IX).
k = size of "A" frame in inches, all taken 5.0 ft. from the butt.

Note.—Usually for power transmission work the line is designed for full kW load, so that no change in loading can be expected for, say, the life of the line. Not so, however, for most distribution lines, and therefore if a good big margin in design is not allowed for, trouble can usually be expected, as other wires are sure to be added with time.

With information of this nature available, the line foreman is given less opportunity of making serious mistakes where closeness of design is intended, *i.e.*, closeness as generally accepted in overhead line pole design, with special reference to sag-temperature, as liberal allowance should be made. Perhaps the greatest error in the design may be the factor of safety, or the factor of safety may be upset by faulty materials or construction and bad workmanship. But as so very many things do this, it is a question whether one fixed value for factor of safety is right for all conditions, &c. For instance, general conditions, as well as the linemen, sometimes have far greater control of the factor of safety than anything or any one else. The linemen, perhaps

*ELEC. REV., October 3rd, p. 516.
†ELEC. REV., September 5th, p. 349.

due to their skill in this class of work, may actually bring the *true* factor of safety down to 1.0, or, due to lack of knowledge or care, or of both, may cause the factor of safety to rise from the allowable figure of, say, 2.0 to 3.0 or worse. In other words, for a given line and locality, &c., the factors of safety may be more in the hands of the linemen than the Commissioners. To illustrate the meaning of such conditions, let us assume a factor of safety of 2.0 for the conductors—although the line supports are the chief questions at issue—then

according to circumstances we may have	(A)	(B)	(C)
Under-estimation due to damage caused to conductor, &c., in transit from the factory and/or stores to the site of erection	25%	5%	0%
Over-estimation of the strength because of injuries due to kinks and other damage to the conductor, &c., during erection	40%	15%	10%
Under- or *over-estimation* due to inaccurate wire stringing ...	45%	15%	−10%
Under or *over-estimation* of loading, due to the impossibility of knowing accurately the amount and effect of loads	40%	20%	−20%
Under-estimated breaking strength due to the impossibility of knowing the proper strength of the material used	15%	10%	0%
Over-estimation of the strength due to impurities in the metal, fatigue under load, conductor deterioration, &c.	10%	10%	0%
Actual load specified	100%	100%	100%
Total	275%	175%	80%
Factor of safety allowed	200%	200%	200%
Surplus strength	−75%	+25%	+120%

Both (A) and (C) represent exceptional conditions. This same reasoning also applies, with proper modifications, to the line supports and other line materials. Thus, due to many diverse causes, which depend upon a great number of variables, condition (A) may be approached in certain far off *lands* and *lines*, but most of the causes may always be non-existent in this country. For instance, line conductors, insulators, and other line materials are not carried many thousands of miles from the factory or stores, and are not subjected to the roughest handling, transportation, climatic conditions, ravages of insects, the crudest workmanship, &c. Moreover, materials of the same quality are not always sent out to the Colonies or abroad, although the same price at the factory is often paid; hence the factor of safety may swing between (A) and (C). One may also reason that, because of the high grade technical skill and high grade workmanship of the bigger power undertakings, the high grade transportation and handling of all materials, the nearness of all supplies to the site of line, &c., the required factors of safety should not be the same for all conditions and all grades of materials and workmanship, &c.; in other words, they should be lower in this country or made higher in those countries subjected to the above-mentioned bad conditions. Perhaps the best reply to this would be to extend facilities to the bigger undertakings for cheaper construction on certain branch lines. Such big power undertakings in this country would not ordinarily under-estimate the ultimate breaking strength or the loading conditions, and the actual strength would not have to be decreased for any cause nor would the stresses be increased by improper stringing of the conductors, &c. It can be assumed that electricity undertakings will always see that the ultimate breaking strength of the conductors corresponds closely with the quality of material bought and erected, and that conductors are strung with sags in accordance with the original design. Failures in nearly every case have been caused by excessive stress due to wrong stringing of the conductors; other cases of failure have been due to the installation of faulty line supports. Obviously all new line supports should be round throughout, be true samples of the new and tested and properly impregnated line supports, and should not be subjected to very rough handling before and during erection, &c. A very careful study of line-support anchoring and cross-arm staying should be given to each particular case. All insulators, pins, cross-arms, and line hardware should be of the best quality, free from all defects. Finally, properly skilled workmen should be employed in the handling of materials and their erection in the field. Certain of the Colonies and certain foreign countries cannot claim these good all-round advantages.

The Southampton Floating Dock.

Electrically Driven and Lighted Throughout.

It will be recalled that the Prince of Wales took part in the ceremony of placing in commission one of the largest floating docks in the world at Southampton in June last. The dock was constructed by Sir W. G. Armstrong, Whitworth & Co., Ltd., to the design of Messrs. Clark & Standfield, of London, for the Southern Railway Co.

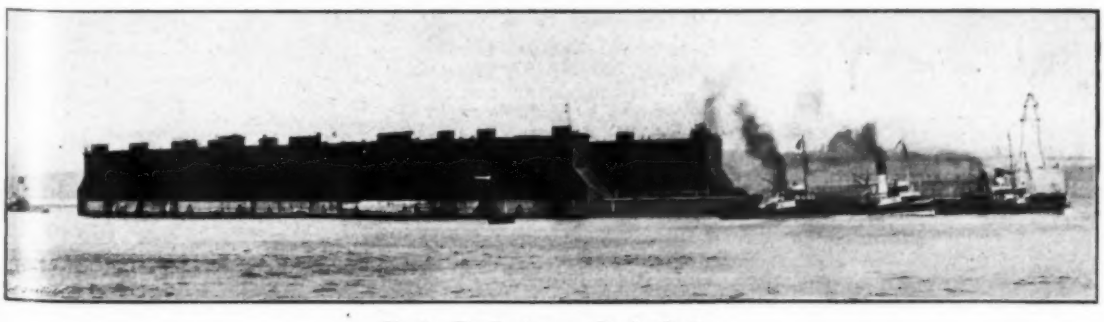

Fig. 1.—The Southampton Floating Dock.

The dock, which is illustrated below, is of the sectional box type consisting of seven sections and is capable of accommodating and lifting a vessel of 60,000 tons total displacement. Its principal dimensions are: Length 960 ft., including a platform 51 ft. 9 in. in length at each end; the overall width is 170 ft. and the clear width 130 ft. 8 in.; the walls are 50 ft. high and the depth of the pontoon is 20 ft. 6 in., making the total height of the structure over 70 ft. The keel blocks are 4 ft. 6 in. in height, and when the dock is sunk sufficiently to give a draught of 38 ft. above the top of keel blocks, the freeboard of the side walls is 6 ft. 6 in. The total weight, including 3¼ million rivets, machinery, fittings, timber, hull, and equip-

ment is about 18,800 tons; the sectional form will permit of self-docking and its length can be increased at any future time by the addition of a new section.

The main interest of the dock lies in the fact that it is electrically operated and lighted throughout. The main cross dock cables for lighting and power and the multicore control cables for valves, telephones, &c., were supplied by Messrs. Johnson & Phillips, Ltd., and are all of the rubber-insulated Association type, lead-covered and wire-armoured to the latest regulations for installation on board ship.

The fourteen main pump motors were manufactured by Messrs. Crompton & Co., Ltd., which firm is allied with Sir W. G. Armstrong, Whitworth & Co. There is one motor on each side for each section and the ten motors for the five central sections are each of 130 b.h.p., the four motors for the two end sections being each of 130 b.h.p., making a total of 1,680 b.h.p., or 1,250 kW. The motors are controlled by a press button system from the valve house on the starboard wall at the bow end; each drives a centrifugal pump in the bottom of the dock by means of vertical shafting. The centrifugal pumps are of Messrs. Worthington-Simpson's manufacture. Three motor-driven air ejectors are fitted on each wall to counteract the tendency of the pumps to draw in air which occurs more particularly towards the end of the operation of lifting a vessel.

Water is admitted into the dock by special inlet pipes provided with screw-down valves worked by hand from the top deck branching from the main drain. They are also provided with flap valves which, together with the direct lift compartment valves, are operated by means of the Westinghouse electro-pneumatic valve-control system from the valve house.

A complete system of telephones connects the valve house to each of the motor houses, and a fire and wash down service is fitted in each wall of the dock. The pumps are capable of discharging 300 gallons per minute at a height of 200 ft. above the pontoon deck and they are electrically driven by independent motors. A small electrically-driven air compressor is installed on each wall for supplying the compressed air for working the valve-control system.

Four electrically-driven side shores are fitted on each side of the dock; each is 63 ft. long, and opposite pairs are geared together and driven by one motor, so that the ship is automatically centred. They have a two-speed movement and were manufactured by Messrs. Clarke, Chapman & Co. A centring device is installed to indicate that the vessel is in the proper position before lifting is commenced.

A three-ton electric warping capstan is fitted at each end of the top deck of each wall to haul chains, &c., about the deck. The two capstans at the bow end will be used for opening and closing a pair of flying gangways giving access from one wall to the other.

The dock is electrically lighted in such a manner that light may be concentrated on any position of the dock, or any position of a ship in the dock.

Fescolising—Electro-Salvage.

Electrochemical Metal Deposition.

THE process of depositing metals electrochemically as applied commercially by Messrs. Fescol, Ltd., of London, is of considerable interest and utility. Our first visit to the firm's works took place three years ago (see ELEC. REV., June 10th, 1921), and a more recent one shows that some very good work is being done. For instance, fig. 1 illustrates an armature the shaft of which has been built up without removing or interfering with the windings in any way, while a particularly good example of reclaimed screw thread is one of the specimens reproduced in fig. 2.

It should be pointed out that while certain patents have been granted, many of the details of working the process remain secret, although it is shown openly in operation. The success of the process depends apparently to a large degree on ensuring that the surface treated is absolutely clean. To this end the article is first immersed in a bath of hot caustic alkali, to remove grease, &c., and then is transferred to a second bath (the composition of which was not disclosed) to remove oxides. An electric current is passed through the article while in each of the baths, with the result that when it is withdrawn from the second bath it has the dead-white appearance of matt silver. The article is next placed in the depositing bath, where it remains until the desired thickness of coating has been deposited. In the case of nickel deposition, the principal salt employed is nickel-ammonium sulphate, the pressure is about 8 volts, and the current approximately 15 amperes per sq. ft. of surface being coated, the electrolyte being circulated and maintained at an almost constant low temperature by special heaters.

When parts of an article are to be treated only, the whole is coated with wax, which is afterwards removed when dry from those surfaces whereon metal is to be deposited. The wax coating is applied between the immersion of the specimen in the first and second cleaning baths. Apparently the only limit to the thickness to which the metal can be deposited is that of cost, and internal deposition can be successfully performed so long as the hole is large enough in diameter to permit the insertion of an electrode without short circuiting. A claim that is borne out by National Physical Laboratory tests is that a coating when once applied cannot be torn away, and if subjected to a destructive test it will be the metal—if the parent and coating are dissimilar—having the lower tensile strength which will yield and not the junction; in fact, the deposit is unstrippable and can only be removed by grinding.

Any one of the following metals, namely, nickel, copper, chromium, cadmium, iron, cobalt, lead, and zinc, can be deposited on itself or on any of the others, but the first two named are those most generally used and they can be deposited upon ferrous metals and their alloys in such a manner that machine parts which are below standard through wear and erosion, or have been machined in error, may be made good. The deposit can be preservative only, from one thousandth of an inch, but it must then be nickel or chromium; or it may be used to rebuild worn parts or salve machine-shop scrap, when, in the case of nickel, it can be applied up to half an inch, although, at the present time, this depth is not an economic proposition. The process affords protection against corrosion and erosion, whether caused by the action of the atmosphere, sea, or chemicals applied industrially.

Deposited nickel has a hardness equal to 300 Brinell (average), the work or flow number being equal to that of unmachinable manganese steel. The engineer can now secure at a small cost a bearing surface that readily lends itself to any machining operation and at the same time possesses wearing properties equal to that of a metal which could only be worked by grinding. Fittings "Fescolised" in nickel require very little cleaning, even when exposed to atmospheric conditions. The Fescol process is a cold one and neither distorts, nor affects the part in any way; the nickel can be applied to hardened and cast or malleable parts and will withstand high temperatures and superheated steam. The deposited metal takes the contour of the original part and can be used for any portion of the part, however small.

Fig. 1.—A Built-up Armature Shaft.

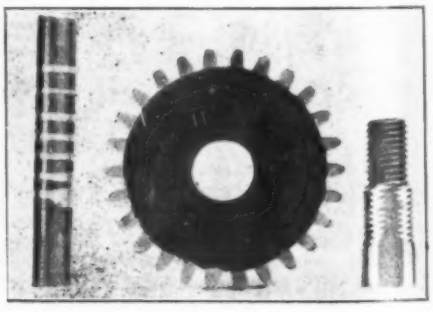

Fig. 2.—"Fescolised" Specimens.

The Swedish Engineering Industry.—The September (quarterly) *Swedish Economic Review* states that during the first quarter of the current year the machine industry showed a satisfactory recovery. This continued, though in a less marked manner, in the second quarter. The latest reports show that the orders in hand are smaller in number than at the beginning of the year. Foreign competition is still severe, particularly in the case of large orders. It has certainly decreased a little on account of the stabilisation of the German currency, but by no means to the hoped-for extent, which is partly accounted for by the disparity between German and Swedish wages.

Sub-Station Control Systems.

Supervisory Management of Plant.

THE continuously increasing interconnection of electricity-distributing networks has created a demand for some means whereby supervisory control may be effected from a central point, located preferably near the centre of load distribution, in order that the plant on the system may be utilised to the best advantage, that faulty sections may be isolated with minimum interference with the rest of the system, that service may be restored with little delay, and that labour charges in operating costs may be reduced as much as possible.

Remotely controlled sub-stations have been in use for some time, and fully automatic plant is being manufactured by several firms and installed in a number of towns, but it is becoming apparent that a combination of the two methods is desirable in many instances. Various manufacturers have devised means of overcoming the apparent complications; in the case under consideration the problem is solved by a combination of some features of the automatic telephone system with others of automatic sub-station apparatus.

Fig. 1.—Supervisory Control Cabinet.

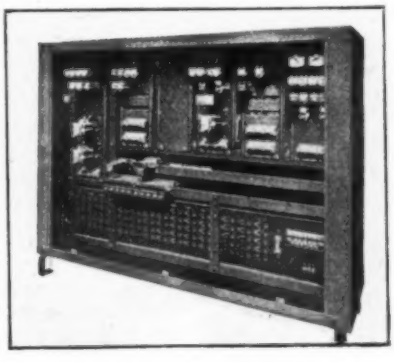

Fig. 2.—Typical Sending Apparatus.

An important consideration is that both forms of gear are in established commercial application; accordingly control can be effected with reliability, and already upwards of 50 supervisory control systems have been successfully installed throughout the world. By its aid an operator at a central point may start and stop automatic stations, open and close air- or oil-break switches controlling machine feeders or system interconnectors, increase or decrease the load on machines, ascertain the head of water and the gate-opening in connection with hydro-electric plant, and the like.

Metro-Vick Supervisory Control.

The apparatus may be arranged to give (i) audible coded signals consisting of either bell rings or buzzes (the least costly system, and suitable for the more simple conditions) or (ii) visual signal lamp indications covering both the completion of any operation and the position at any time of any piece of apparatus.

Visual supervisory control will be appreciated by a consideration of the accompanying illustrations of the gear that was exhibited by the Metropolitan-Vickers Electrical Co., Ltd., at the British Empire Exhibition in conjunction with a 500-kW automatically-controlled rotary converter equipment. A typical control cabinet is shown in fig. 1; it is approximately 11 in. high and wide by 9 in. from back to front, and contains six operating keys with signalling lamps.

To initiate any operation, all that is necessary is to throw over the appropriate control key. With each key three signal lamps are associated; a red one indicates when a circuit breaker is closed, a green lamp indicates when it is open, and a white lamp is alight during the progress of any operation, the most complicated of which being completed within a few seconds. The keys and lamps may be arranged in any desired way, *e.g.*, both grouped in cabinet or desk form, or the lamps may be arranged in a line diagram representing the connections of the system. Sending and receiving equipments (the former is illustrated in fig. 2) are very much alike, and mounted within sheet steel cabinets with front and back doors made detachable to give complete access to all parts. All the components are of standardised design, consisting principally of selector switches as illustrated in fig. 3 and of auxiliary relays; every part is arranged with easy fitting knife jaw connections, so that any unit may be withdrawn and replaced immediately by a spare unit.

The movement of a key transmits coded impulses through pilot wires exactly as in the operation of the dial of an automatic telephone. A small battery usually arranged for 48 volts is installed in the sending station and in each receiving station (for large sending equipments a motor-generator set floating across the battery may be added). Operation of the control key causes the sending equipment to transmit signals to the appropriate receiving apparatus, and this in turn operates suitable relays which energise small contactors to govern the closing or trip coils of circuit breakers, or otherwise effect the desired operation.

An important characteristic is the provision of complete safeguards against improper operation; the operation of several keys at one time will cause no confusion, the sending apparatus picking up each key in turn till all the desired signals have been transmitted; should the codes be interrupted from any causes, the sending apparatus continues to repeat its code until the desired operation has been performed and a confirmatory signal received, the white signal lamp meanwhile remaining alight to indicate an incomplete operation. To control a single sub-station three pilot wires only are necessary, two being taken to all further sub-stations and an additional wire being required to each.

Radio Control.

The system has been carried a step further by the recent demonstrations of the possibility of obtaining "wireless" supervisory control, and thus dispensing with the use of pilot cables. As already described, radio signals emanating from the company's Trafford Park works at Manchester were picked up on a receiver in the Palace of Engineering at Wembley and passed on to a selective relay which, in turn, caused the automatic gear to function so as to start and stop the rotary converter.

While this was the first demonstration in this country of the practicability of the application of the method to industrial purposes, it is of interest to note that in America it became an accomplished fact with the inauguration of the radio control of a complete sub-station at Tipton, Ind., without the presence of a single attendant, by means of high-frequency waves emanating from Kokomo, Ind., about 35 miles away, and a receiver much like a broadcast listening set.

According to the *Electrical World*, the Northern Indiana Power Co., which placed the system in operation after tests extending over a year, declares that it is the first time on record that radio waves from a distant point have been employed to operate a complete sub-station supplying a city of 5,000 population. To ensure an uninterrupted supply for the city, two transmission lines are employed from power plant at Kokomo and Noblesville. Heretofore the operation of oil switches, used to change the connection, has necessitated the constant presence of sub-station assistants, who

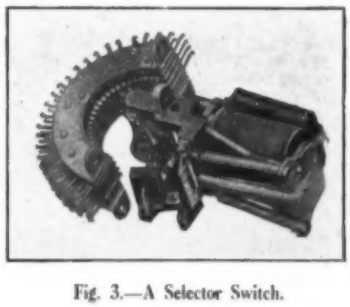

Fig. 3.—A Selector Switch.

have received instructions by telephone from Kokomo. The telephone has not been invulnerable to storms, and at times great difficulty has been encountered.

Under the new system, if trouble develops on either of the lines entering the station, which is controlled by two oil circuit breakers of 73,000-volt, 400-amp. rating, with a rupturing capacity of 1,500,000 kVA, it is instantly observed on power-house instruments at Kokomo. An operator sends out high-frequency waves, which open the oil switch at Tipton connected to the defective line and close the oil switch connected to the reserve line, the whole operation being completed in a few seconds.

The waves, which are sent out from Kokomo by the operation of a dial similar to that used on an automatic telephone,

are received on an antenna at Tipton and led to a five-valve receiving set and amplifier. They are then carried to a series of selector relays, which in turn operate the storage-battery switches actuating the oil-circuit-breaker mechanism. The special wave-length is outside broadcasting range, and the series of impulses is said to be very complex.

The wireless apparatus was designed to specifications of Mr. John Ferguson, of Indianapolis, manager of operation of the company, and built by the Westinghouse Electric and Manufacturing Co. About six similar stations may be installed in the State within the next year, Mr. Ferguson says.

The Electrical Exports of Chile.

The following figures, showing the values of the imports of electrical and allied goods into Chile in 1922, are taken from the recently published official trade returns. For purposes of comparison the figures for 1921 are given, and notes of increases or decreases are made :—

	1921. Pesos.	1922. Pesos.	Inc. or dec. Pesos.
Insulators for telegraphs and telephones—			
Total	368,000	162,000	– 206,000
From United States	235,000	81,000	– 154,000
,, Gt. Britain	17,000	18,000	+ 1,000
,, Germany	94,000	55,000	– 39,000
Wire, insulated or sheathed (covered)—			
Total	750,000	324,000	– 426,000
From Germany	197,000	189,000	– 8,000
,, Japan	195,000	13,000	– 182,000
,, United States	169,000	35,000	– 134,000
,, Belgium	89,000	9,000	– 80,000
,, Gt. Britain	76,000	53,000	– 23,000
Incandescent electric lamp bulbs—			
Total	1,161,000	740,000	– 421,000
From Germany	360,000	333,000	– 27,000
,, United States	242,000	160,000	– 82,000
,, Holland	404,000	174,000	– 230,000
,, Gt. Britain	95,000	51,000	– 44,000
Apparatus (various) for electric lighting—			
Total	1,675,000	998,000	– 677,000
From United States	776,000	248,000	– 528,000
,, Gt. Britain	232,000	381,000	+ 149,000
,, Germany	587,000	333,000	– 254,000
Telephone apparatus—			
Total	1,307,000	242,000	–1,065,000
From Gt. Britain	750,000	65,000	– 685,000
,, Germany	322,000	82,000	– 240,000
,, Belgium	98,000	8,000	– 90,000
,, United States	80,000	46,000	– 34,000
Telegraph apparatus—			
Total	155,000	23,000	– 132,000
From Germany	52,000	9,000	– 43,000
,, Argentina	10,000	4,000	– 6,000
,, United States	41,000	3,000	– 38,000
,, Gt. Britain	49,000	6,000	– 43,000
Wireless apparatus—			
Total	98,000	367,000	+ 269,000
From Gt. Britain	—	345,000	+ 345,000
,, Germany	94,000	—	– 94,000
Electric cables—			
Total	2,773,000	4,163,000	+1,390,000
From Germany	229,000	299,000	+ 70,000
,, United States	1,137,000	962,000	– 175,000
,, Gt. Britain	1,343,000	2,742,000	+1,399,000
Electric bells and parts thereof—			
Total	9,000	11,000	+ 2,000
From Germany	6,000	7,000	+ 1,000
,, United States	2,000	—	– 2,000
,, Gt. Britain	—	3,000	+ 3,000
Pipes and tubes, insulated for electrical purposes—			
Total	85,000	51,000	– 34,000
From Germany	68,000	39,000	– 29,000
,, United States	12,000	8,000	– 4,000
,, Gt. Britain	—	2,000	+ 2,000
Carbons for electrical purposes—			
Total	53,000	62,000	+ 9,000
From United States	12,000	—	– 12,000
,, Gt. Britain	33,000	50,000	+ 17,000
,, Germany	6,000	11,000	+ 5,000
Dynamos, motors and parts thereof—			
Total	2,275,000	2,281,000	+ 6,000
From Germany	748,000	273,000	– 475,000
,, United States	100,000	1,716,000	+1,616,000
,, Gt. Britain	381,000	239,000	– 142,000
,, France	53,000	1,000	– 52,000
Electric lamps (other than incandescent bulbs)—			
Total	221,000	97,000	– 124,000
From Germany	105,000	59,000	– 46,000
,, United States	61,000	12,000	– 49,000
,, France	19,000	2,000	– 17,000
,, Gt. Britain	13,000	17,000	+ 4,000
,, Holland	11,000	1,000	– 10,000
Meters—			
Total	232,000	157,000	– 75,000
From Germany	94,000	41,000	– 53,000
,, United States	84,000	11,000	– 73,000
,, France	24,000	2,000	– 22,000
,, Gt. Britain	22,000	99,000	+ 77,000
Cells and accumulators—			
Total	363,000	365,000	+ 2,000
From Germany	103,000	64,000	– 39,000
,, United States	159,000	96,000	– 63,000
,, Gt. Britain	88,000	166,000	+ 78,000
Posts for supporting electric wires and cables—			
Total	25,000	137,000	+ 112,000
From United States	21,000	1,000	– 20,000
,, Gt. Britain	4,000	35,000	+ 31,000
,, Germany	—	100,000	+ 100,000
Electric fans—			
Total	28,000	3,000	– 25,000
From Germany	10,000	1,000	– 9,000
,, United States	14,000	—	– 14,000
,, Gt. Britain	3,000	—	– 3,000
Electrical machinery, apparatus and parts of same (unspecified)—			
Total	1,827,000	3,012,000	+1,185,000
From United States	1,353,000	2,220,000	+ 867,000
,, Germany	320,000	202,000	– 118,000
,, Gt. Britain	132,000	489,000	+ 357,000

[Peso = 1s. 6d.]

Electrical Precipitation.

A plea for the electrical control of the atmosphere, by assisting natural precipitation artificially, was put forward by Sir Oliver Lodge in a lecture to the Institute of Physics, at the Institution of Electrical Engineers' building, on Wednesday, October 29th. The Institute of Physics has arranged a series of public lectures on "Physics in Industry," and Sir Oliver's discourse on "Electrical Precipitation" was the seventh of that series.

The subject of electrical precipitation divides itself into two parts, the natural and the artificial. Sir Oliver dealt first with the natural precipitation, *i.e.*, that which occurs in the atmosphere when clouds turn into rain, then discussed the application of high-pressure electricity to the recovery of metallic fume and to the freeing of blast-furnace gas from solid material before combustion, &c. (of which he is a pioneer), and finally envisaged the control of rainfall by electricity.

In connection with natural precipitation, the lecturer discussed the electrical phenomenon produced by the forcible separation or decoherence of two surfaces, and also the correlative phenomenon of the union or cohesion of two surfaces under applied electric stimulus, as investigated by the late Lord Rayleigh and other eminent workers. Natural electrical precipitation occurred in the atmosphere when clouds turned into rain, and also when large water-drops broke up in a column of ascending air, giving rise to separation of electricities and the phenomenon of thunderstorms, as shown by Dr. G. C. Simpson (a great meteorologist). It was extraordinary that the mere breaking-up of water should electrify it, and he suggested a theory of it on the lines of the coherer and water-drop experiments, since he regarded the breaking-up of a drop as the converse action to the cohesion of two drops. Electrical influence stimulated cohesion, and it was possible that absorption might give rise to electrical separation. It was not that the two fragments became oppositely electrified, but because the uniting electronic layer was blown away by the air, thus carrying away a negative charge and leaving the residual water positive.

For all practical purposes, said Sir Oliver, it might be stated that artificial precipitation dated from the time when he showed to the British Association at Montreal, in 1884, his well-known experiment on the electrical deposition of smoke or steam. His lecture was the result of an observation which was made by himself and the late Mr. J. W. Clark, at Liverpool, in that year, though something of the same sort had been observed casually by another worker about 1850, and he had just learned that a similar observation had been made in 1824, so that the current year was its centenary. Mr. Clark and the lecturer began by inquiring into the phenomenon of the dark plane or dust-free space rising from hot bodies, which was made visible by letting the air stream upwards into a horizontal beam of light. Lord Rayleigh had found that quite a

small excess of temperature, such as that of hot water communicated to a rod, would suffice to give a dust-free plane of singular definiteness and regularity, rising as a lamina from the rod. It appeared from continued investigation by Sir Oliver and his collaborator that small dust particles could not get into contact with a hot body, or even a warm body, but were bombarded from it by molecular impacts—very much on the lines of Crookes's radiometer; the force being more effective on the minute particles of dust than on the large vanes of the radiometer. Other experimenters also showed, in many interesting ways, that a warm surface would keep itself clear of dust, and Sir Oliver tried the experiment of electrifying a rod. This showed that the dust-coat thickened and expanded, and rapidly extended into the box, so that the whole box was cleared of dust by the electrification. He then electrified dusty air, not on a small careful metrical scale by means of a battery, but in a larger and more violent way, with a Voss or Wimshurst machine. It was found that the particles aggregated together, hovered in the air for a short time, and then clung to the floor and walls of the vessel, the effect being particularly rapid and efficient when brush discharge took place from a point. Also, it was found that when a bell-jar was filled with steam, electrification caused the ultra-microscopic drops to cohere together, and fall as fine rain.

Soon after the Montreal lecture, the effect of electrical precipitation was tried on a large scale at some smelting works in N. Wales, where a quantity of lead dust escaped into the atmosphere, damaging neighbouring agriculture. This first attempt was unsuccessful, however. The means of producing high-pressure electricity in those days was rather primitive, and by no means of an engineering character, and the difficulties of insulation were not properly appreciated by those responsible. It was doubtful if any real electrification was communicated to the flues, along which the hot, flaming and smoky gases were rushing at a considerable pace from the smelting furnaces. A few years later, however, the attempt was made again, after many large-scale laboratory experiments at Liverpool, carried out by Mr. Lionel Lodge (Sir Oliver's son). By that time improved vacuum valves enabled the discharge from an induction coil to be rectified so that continuous high-pressure electrification could be maintained from a dynamo current, in a more satisfactory and engineering manner than by an electrostatic machine, such as had been used in the previous case. Moreover, the kind of electrodes most suited to the apparatus became known, and special insulators were constructed to hold them. The best results were obtained by suspending oppositely-charged metal surfaces alternately in a large precipitation chamber, alternate ones being provided with point or edge dischargers. Many subsidiary contrivances were devised to meet various difficulties, such as the clogging of the points or edges by the dust, but finally the arrangement became practical.

The process had also been applied to smelting and other works on a large and successful scale in America by Dr. Cottrell, whose firm amalgamated with the Lodge Fume Deposit Co., which had been started in this country. A number of patents had also been taken out independently in Germany by a Dr. Moeller, and had been applied on a large scale. Altogether, there are some 200 plants in operation in various parts of the world.

A number of processes to which the principle of electrical precipitation had been applied with success were then described and illustrated by the lecturer. It had been applied on a large scale during and since the war to the extraction of dust from blast furnace gases at ironworks, not so much from the point of view of recovering the dust—which was, nevertheless, of some value—but because dust-free gas burned better than gas from which the dust had not been extracted; it was more efficient for heating the hot-blast and generating steam without clogging the flues or interfering with effective combustion and doing other damage. The dust, moreover, contained potash, which was of value, but in some cases it was contaminated with other materials, such as cyanide, and the easiest plan appeared to be to waste it, at the moment. Here, however, was opportunity for the chemist. The extraction of dust from blast furnace gas was not an easy problem, but Sir Oliver expressed his admiration for the engineering skill which enabled high-pressure d.c. electrification, at a potential of nearly a hundred thousand volts, to be applied continuously, night and day, in enormous chambers to rapidly-moving hot gas, with very little attention, so that some 95 per cent. of the dust was deposited, and tons of the solid material, shaken off mechanically from the electrodes and collected in channels or chutes, were deposited every day and thrown down into hoppers, to be collected by railway trucks.

In the case of a tin-smelting works near Bootle the material recovered was re-smelted, and thus very great economy was effected. Tin-oxide fumes, which formerly escaped into the atmosphere, were saved, together with the smoke and other solid material from the furnaces, and the installation had proved to be very remunerative. The process was applicable to liquids (such as sulphuric acid), dust, blast-furnace gas, lead, &c., but lead seemed to present some little difficulty.

Examples of precipitation chambers were shown. One type consisted of a number of plates, with wires between them for discharging the electricity between the plates. The air to be dealt with passed through the chamber, depositing the dust on the plates. There were subsidiary contrivances, such as pockets for collecting the dust which might otherwise be blown away by the force of the air passing through, and for vibrating the plates in order to prevent them from becoming clogged, there being hoppers below for collecting the dust so displaced. In other types there were tubes, each having a wire or a chain running through it vertically. The wire or chain was suspended from a busbar, and kept taut by a weight suspended at the bottom. The air to be treated passed either upwards or downwards through the tubes.

Precautions had to be taken to guard against accidents resulting from the high voltage used, and in one case referred to, in order that the chambers should not be opened while the process was being carried out, arrangements were made so that, as soon as the key of the inspection door was taken from its hook, everything in the chamber was short-circuited to earth, and the process was not re-started until the door was locked and the key replaced.

SIR OLIVER was not sympathetic towards the suggestion that the method of electrical precipitation of dust and smoke might be applied to the atmosphere of large towns, his view being that the best way to deal with town smoke was to avoid producing it, and to improve methods of combustion. Moreover, the difficulties of applying the precipitation method were great.

An application of electrical precipitation which he did regard as hopeful, however, was in regard to the control of rainfall. Though we had learned, he said, that the precipitation of moisture depended on electrical conditions, and though rain came down electrically charged, in a way which ought to give us a hint, we still supplicated higher powers for the production or the limitation of rain, instead of setting to work to see what we could do for ourselves. Though the problem was difficult, so were all problems until we tackled them, but the peculiarity of atmospheric difficulties was that they were on so large a scale that no ordinary laboratory experiments, or anything within ordinary private means, sufficed. Now that it was possible to produce high-pressure electricity, however, on an extensive engineering scale, it seemed that something ought to be attempted. Whether the stopping of rain or the production of rain was the easier problem he did not know, but the greater part of the world suffered from drought, and, instead of allowing clouds to accumulate and disappear without precipitation, he suggested that they might be electrified; or, since they were probably already electrified, the sign of the electrification might be changed; or, again, that one part of a cloud might be electrified differently from another part, so that the drops in it should be of different potential, and be likely to run together and coalesce. There were difficulties about the electrical control of the atmosphere, but was that to be the one region of the earth over which man had no power, and about which he must succumb supinely to fate? He did not believe it was, and felt sure that if the control of atmosphere was felt to be an important problem it would be tackled either now or by posterity. Anyhow, the problem appealed to him as being no more difficult than the problem of disease at one time appeared.

Electric Train Lighting from H.P. Traction Supply.

A Self-regulating Motor Generator.

IN order to overcome the trouble hitherto experienced in obtaining a substantially constant low pressure for the lighting and other auxiliary circuits on electric trains, the British Thomson-Houston Co., Ltd., has recently invented

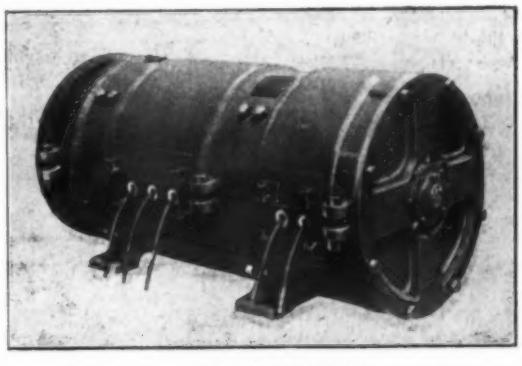

Fig. 1.—New Train-lighting Set.

a self-regulating motor-generator set which provides the current necessary for the lighting, heating, and control circuits for operating the contactors, reversers, circuit-breakers, &c., on locomotive-hauled or multiple-unit electric trains taking power at a high pressure from the collector rails or overhead trolley lines.

Owing to the voltage fluctuations which occur on a h.p. traction system, it is difficult to design a machine which will provide current at a low voltage steady enough to eliminate objectionable flickering of the lamps; but this has been achieved in the new compound-wound motor-generator set. Although described as a motor-generator, the machine acts partly as a genemotor (or dynamotor) and has its magnetic circuits and windings so arranged that the voltage regulation is obtained independently of the load on the set without the use of any external regulator. Even with the first experimental set the full-load efficiency reached the high value of 73 per cent., which means that a large output can be obtained from a machine of small dimensions and weight.

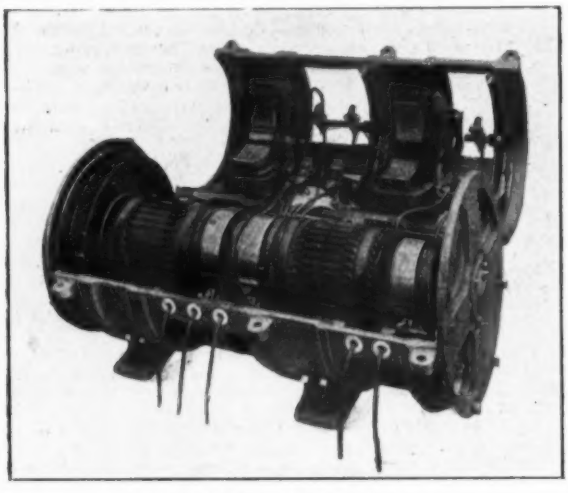

Fig. 2.—Machine with Top Casing Open.

On the company's stand in the Palace of Engineering at the British Empire Exhibition a 10-kW set of this kind (fig. 1) was included in the section devoted to traction motors, control gear, and accessories. Although reducing a fluctuating line pressure of 1,500 volts (normal) to 125 volts, it has an overall length of only 3 ft. 10 in. and a diameter of 1 ft. 11 in., its weight being 1,500 lb. The general design allows of easy access to the three commutators and their brush gear. Owing to the magnet frame being divided on the horizontal axis, and provided with hinged bolts on one side, one half of the frame can be completely opened without in any way interfering with the internal connections, as shown in fig. 2. In order to open the frame in this way it is only necessary to slacken the nuts on the hinged bolts and remove the bolts from the other side of the frame.

Our Foreign Trade in Electrical Machinery.

A LENGTHY review of our exports and imports of machinery of all kinds appeared in the *Board of Trade Journal* for October 30th. In this, quantities are used as a basis of comparison between the trade in pre-war years (1911-13), 1922, 1923, and the first nine months of the current year.

As an indication of the general trend, we reproduce part of the first table in the article which compares imports and exports in the mass without distinction of kinds.

IMPORTS AND EXPORTS OF MACHINERY.

In Thousand Tons.

—	Avge. 1911-13.	1922.	1923.	1924. First Quartr.	1924. Second Quartr.	1924. Third Quartr.
Imports	23'3	45'7	53'8	14'1	15'8	14'0
Re-exports	19'6	4'2	3'7	1'0	1'4	1'1
Retained	7'7	41'5	50'1	13'1	14'4	12'9
Exports British Products	711'2	401'4	432'5	103'8	115'7	118'9

It will be seen from this that the figures are still below the average for 1911-13, although the tendency is towards improvement. Coming to details, it is observed that this general aspect is reflected in the volume of internal-combustion and steam engines and electrical machinery. With regard to the last, we think that the statistics reproduced herewith will be of interest to our readers.

"Our retained imports of electrical machinery have been coming in in 1924 at the rate of 41.8 per cent. of the pre-war rate, while our exports were going out at a rate of 22.5 per cent. greater than our exports in 1911-13. Before the war our retained imports were equivalent to 38 per cent. of our exports; to-day they are at the rate of 12.9 per cent. The recovery in export trade since 1922 is very noteworthy, and characterises all branches of the industry except rotary converters and direct-current generators, the former of which showed a decline and the latter was practically stationary in 1923. The rate of export of the first quarter of 1924 has been scarcely maintained in the subsequent months.

"Before the war our imports came chiefly from Germany and the United States, with Sweden as a bad third; imports from all these countries fell off heavily in 1922, Belgium, France, Switzerland, and Canada making moderate gains. In the export trade the chief features are the large decrease in exports to South American countries, especially Argentina, and the considerable gains in exports to China, India, Australia, and New Zealand. Some ground was lost in India in 1923 compared with 1922, but the result for 1923 was much better than before the war. Australia and New Zealand improved considerably on business in 1923, which in the previous year was rather below the pre-war level. The Union of South Africa made a very marked recovery in 1923 over the poor result of 1922."

IMPORTS AND EXPORTS OF ELECTRICAL MACHINERY.

—	Average 1911-13.	1922.	1923.	1924. 1st Qtr.	1924. 2nd Qtr.	1924. 3rd Qtr.
Imports from—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Sweden	620	383	748			
Germany	5,697	1,103	545			
Belgium	422	490	109	Details not yet published separately.		
France	158	429	161			
Switzerland	210	648	495			
United States	2,620	1,012	1,650			
Canada	22	173	186			
Other countries	215	288	277			
Total	9,964	4,526	4,171	874	1,250	939
Re-exported	644	95	290	45	68	29
Retained	9,320	4,431	3,881	829	1,182	910
Retained imports of—						
Generators:						
Alternating current		1,097	234			
Direct current		409	288			
Motors—						
Railway and Tramway		21	17			
Other—						
Alternating current	Not separately distinguished.	495	652	Details not yet published separately.		
Direct current		378	591			
Converters and transformers (including coils)—						
Rotary		34	70			
Static		163	86			
Control and switchgear		29	73			
Magnetos, ignition		15	19			
Other electrical machinery		1,790	1,851			
Total	9,320	4,431	3,881	829	1,182	910
Exports to—						
Belgium	400	519	243			
France	614	439	941			
Spain	567	279	912			
China	280	728	710			
Chile	580	312	269			
Brazil	1,313	286	599	Details not yet published separately.		
Argentina	2,248	421	443			
South Africa (Union)	1,794	648	1,550			
India	2,597	5,236	4,775			
Australia	3,606	3,500	4,062			
New Zealand	936	870	1,392			
Other countries	9,696	3,495	5,107			
Total	24,531	16,733	21,003	7,721	7,489	7,318
Generators—						
Alternating current		1,813	2,452	3,953	3,401	3,165
Direct current		1,837	1,854			
Motors—						
Railway and Tramway		706	1,990	738	607	679
Other—						
Alternating current	Not separately distinguished.	3,185	3,293	With generators.		
Direct current		1,768	2,907			
Converters and transformers (including coils)—						
Rotary		1,495	859			
Static		1,365	1,933			
Control and switchgear		1,978	2,178	3,030	3,481	3,474
Magnetos, ignition		12	20			
Other electrical machinery		2,484	3,514			
Total	24,531	16,733	21,003	7,721	7,489	7,318

Another section, of which details are given in the report, is "boilers and boiler-house plant." Here, again, the post-war returns show a serious decline in exports, with a tendency toward improvement. Imports retained on the other hand, increased by about 50 per cent. over the pre-war figure in 1922, although they fell to a little above that figure in 1923. This information is qualified, however, by the fact that pre-war and post-war classifications are different.

Machine tools are higher than in 1911-13 on the import side, while the exports show a slight decrease.

From a table given by the *Journal* showing the distribution of exports it can be seen that, while our Empire trade remained at about the pre-war level, the volume exported to other countries in 1923 was considerably below half of the 1911-13 average. Russia and Germany accounted for a great deal of this loss, in Europe; among non-European countries Argentine custom showed the greatest decline.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

G.E.C. Shielded Lampholders.

Regulation No. 21, on page 60 of the Memorandum on the Electricity Regulations, 1924, requires lampholders to be either earthed, or made of, or completely covered with suitable insulating material, so that neither the holder nor the metal cap of the lamp can be touched. Hitherto, this regulation has been taken as referring only to the ordinary bayonet cap lampholder, and until quite recently only lampholders of this type were obtainable shielded to comply with Home Office regulations. The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, however, informs us that at the suggestion of the Home Office it has now completed a series of Home Office pattern shielded lampholders by the addition of Edison screw holders and G.E.S. holders, which are adequately protected by insulating shields. The development in recent years of the use of high-candle-power gasfilled lamps having Edison screw or G.E.S. caps renders this protection very necessary, as it must be remembered that the whole of the metal part of the cap of such lamps is "alive" when the lamp is switched on. The Edison screw Home Office pattern lampholder is illustrated in fig. 1. The metal parts of the lampholder are of standard pattern, but mica insulation is used between the centre contact and the screwed liner. The insulating shield, as in the case of all G.E.C. Home Office pattern lampholders, is of "Wittonite" fireproof insulating material. An efficient cord-grip and substantial wiring terminals are provided.

The G.E.S. Home Office pattern lampholder is a standard G.E.C. "Goliath" holder in china case, with ¼ in. gas or ⅜ in. brass thread entry at the top. Around the base of this holder is clamped, by means of small bolts and nuts, a moulded cylinder of "Wittonite" made in two halves, of such proportions that it adequately eliminates all risk of the metal part of the lampholder or lamp being touched. Ordinary unshielded G.E.S. lampholders already installed may be easily protected, as the insulating cylinder or sheath can be obtained separately. The G.E.S. Home Office pattern lampholder is shown in fig. 2.

Fig. 3 shows the standard G.E.C. Home Office pattern B.C. holder. The form of cord grip should be noted, slots in the bridge piece between the two terminals replacing the usual holes and facilitating wiring.

Fig. 1.—The G.E.C. Edison Screw Shielded Lampholder.

Fig. 2.—The G.E.S. Shielded Lampholder.

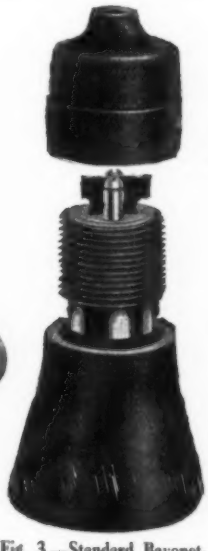

Fig. 3.—Standard Bayonet-cap Protected Holder.

The "Selco" Mechanical Line Fastener.

Among the many difficulties met with in the erection of overhead lines, whether telegraph or power lines, is the problem of the securing of the wires to the pole insulators. For years this has been carried out by means of binding wire, a method that entails considerable trouble, a certain amount of skill, and a risk of injuring the current-carrying wire with the tools used, the last sometimes resulting in a complete breakdown, as well as consuming time. When secured in this manner, too, the line-wire is free to move longitudinally across the insulator, causing wear on both components, and where the line-wire is forced into closer contact with the insulator, the strength of the line is reduced by the sharp bend which it is apt to receive.

To overcome these difficulties the "Selco" mechanical binder has been introduced into this country by MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C. The principal features of this are the use of wide and slightly bent claws which take hold of the line-wire and press it firmly against the neck of the insulator. Besides the ordinary variations in the size of the insulators and in the diameter of the neck, abnormal variations occur in the process of manufacture. These are taken care of in the "Selco" fastener, which consists (see fig. 4) of a pair of wide claws (1 and 2) which grip the line-wire when placed across it from above, and a lever (3), to one end of which a strap (4) is attached, while the further end is attached to the claw (2). The pivot of the lever slides during the adjusting process in an oblong hole or slot, and by the aid of a key or, in the case of small insulators, with the finger, the lever is turned over into its final position. During this movement the pivot pin of the lever turns first about the inner end of the slot, but subsequently the pressure on the line-wire causes the pivot to slide outward, and the fastener is thereby locked.

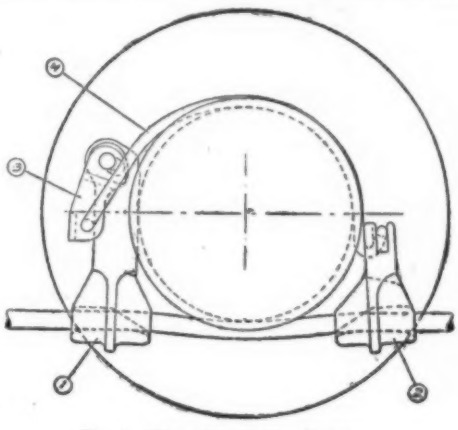

Fig. 4.—The "Selco" Line Fastener.

To suit special applications, adaptations of the device are available. One outstanding feature of the fastener is the ease with which it can be removed. Fig. 5 shows an application of the device.

Fig. 5.—Method of Employment of the "Selco" Fastener.

New Electric Fires.

Since the publication of our articles upon this subject we have received details of other manufacturers' products.

ELECTRIC FIRES, LTD., King Street, Norwich, has put on the market a new pattern double purpose fire which has been named the "Companion" (fig. 6). The fire front is fitted with two standard "Heatrae" 1-kW fire-bars and has a boiler on top with 1 kW loading. The construction is such that it will be eminently suitable for hiring out purposes, the framework being of angle steel and the body of stout sheet steel, finished in black enamel. The boiling plate on top is of cast-iron,

ground and polished, and nickel-plated. The reflector insets round the fire bars are of polished aluminium and these, together with the guard wires, are fitted up to form a complete frame, removable by taking out two brass screws, which gives

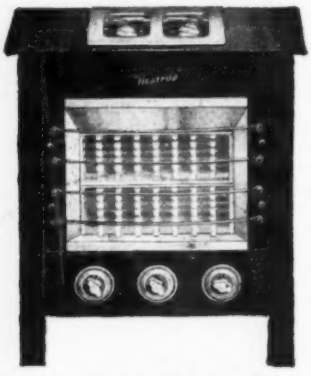

Fig. 6.—The "Companion" Fire.

ready access to the fire bars, while at the same time covering up all screws, nuts, connections, &c., when the fire is in its normal condition. The top plate enclosing the boiler is also removable by taking out two brass screws.

Another fire is the "Equator" pattern made by the CABLE ACCESSORIES CO., LTD., Tividale, Tipton, Staffs., and illustrated in fig. 7. In this the imitation glowing coal is made of an unbreakable fireproof transparent material removable in

Fig. 7.—The "Equator" Fire.

Fig. 8.—The "Quead Junior" Fire

one piece. The fire has a reflector back and is designed to look as much like an ordinary grate as possible. The loading is 2 kW with two heat controls.

Another useful design is the "Quead Junior" (fig. 8), marketed by Messrs. WM. GEIPEL & Co., Vulcan Works, St. Thomas Street, S.E.1. This is a dual-purpose pedestal heater—for general heating or for boiling. The pedestal is of black-enamelled cast-iron, and the reflector of solid copper. The handle at the back of the bowl forms a terminal box and back rest. The swivelling arrangement permits the bowl to be locked at any angle. The coiled nichrome element is wound in a spiral groove moulded in a cylinder of refractory material; the loading is 600-W, and the fire weighs only 3¼ lb.

Industrial Electric Heating.—In the U.S.A., electric heating finds an important application in the low-temperature heat treatment of small steel parts. During the past year, a device has been developed for electrically pre-heating mill rolls preparatory to rolling hot steel sheets. Methods previously in use involved a series of gas flames, or hot-water jets played on the rolls during the warming-up period. By the use of electric heat, the rolls are more uniformly heated, the warming-up period is shortened, roll breakage is decreased, and a better steel sheet results. Electric space heaters are now being installed in the frames of rotating machines in order to keep the windings warm and prevent sweating during long periods of idleness. This results in a materially longer life for the insulation, and lessens the danger of breakdown. During 1923 electric ovens were, for the first time, successfully used for the bright annealing of copper wire. The oven is mounted on wheels and is moved back and forth over two hydraulic platforms, one of which can be loaded while the other is in the heating chamber. A water seal keeps air from this chamber. The wire is uniformly annealed at all points in the oven and the product is bright and free from scale. The connected load is 300 kW, 550 volts, 3-phase, and 7,000 lb. of copper wire can be charged at one time and fully annealed in 75 minutes, the energy required averaging about 1 kWh for each 25 lb. of wire.—A.I.E.E. *Journal*.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

9,367. "Methods of and means for neutralising capacity coupling between electric circuits." W. J. Mellersh-Jackson (Independent Radio Manufacturers, Inc.). April 5th, 1923. (222,894.)

9,402. "Methods of and means for neutralising capacity coupling between thermionic valve circuits." W. J. Mellersh-Jackson (Independent Radio Manufacturers, Inc.). April 5th, 1923. (222,895.)

9,413. "Wireless broadcasting." Skinner Organ Co., Inc. March 20th, 1923. (211,090.)

12,383. "Liquid-tight coating on porous bodies, particularly applicable on the porous bodies of electrodes of batteries or electrolysing apparatus." Soc. Anon. Le Carbone. June 1st, 1922. (198,656.)

12,659. "Mounting of electric heating elements." E. R. I. Nordstrom, E. O. Johannson, and H. T. Tillquist. May 11th, 1923. (222,907.)

12,715. "Liquid-tight coating on porous bodies, particularly applicable on the porous bodies of electrodes of batteries or electrolysing apparatus." Soc. Anon. Le Carbone. November 3rd, 1922. (Addition to 198,656.) (206,471.)

15,068. "Rotary converters." P. Georgoussis. June 8th, 1923. (222,914.)

17,275. "Electric sound-reproducing apparatus, including transmitters, receivers (loud speakers), and the reproduction of recorded sounds." A. F. Sykes. July 3rd, 1923. (Cognate application 10,975/24.) (Addition to 160,221.) (222,924.)

17,363. "Adjustable inductances." Igranic Electric Co., Ltd., and A. E. Brooks. July 4th, 1923. (222,928.)

17,612. "Sound reproducers such as are employed in telephone sets, gramophones, and the like." C. Hering. July 6th, 1923. (222,935.)

17,732. "Electric circuit-breakers and the like." British Electrical and Allied Industries Research Association, W. B. Whitney, and E. B. Wedmore. July 9th, 1923. (222,942.)

17,791. "Mounting of loud-speaking telephonic apparatus." E. A. Graham. July 9th, 1923. (222,944.)

17,835. "Electric switches." H. J. Norballe. July 10th, 1923. (222,949.)

18,001. "Loud-speaking telephones." E. A. Graham. July 11th, 1923. (222,961.)

18,002. "Loud-speaking telephonic apparatus." E. A. Graham. July 11th, 1923. (222,962.)

18,066. "Electric incandescent lamps, thermionic valves, and similar devices." N. Wise. July 12th, 1923. (222,964.)

18,089. "Head telephone receivers." Sterling Telephone & Electric Co., Ltd., and F. R. Griffiths. July 12th, 1923. (Cognate application 11,224/24.) (222,967.)

18,194. "Static frequency changers." M. Latour. July 13th, 1922. (200,835.)

18,419. "Thermionic amplifiers." P. G. A. H. Voigt. July 17th, 1923. (222,981.)

18,991. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). July 24th, 1923. (222,994.)

20,169. "Enclosed circuit air-cooling systems for the ventilation of electrical machinery." Heenan & Froude, Ltd., G. H. Walker, G. W. Black, and A. W. Ardern. August 8th, 1923. (223,007.)

20,604. "Horns for use in the reproduction of sound." Marconi's Wireless Telegraph Co., Ltd. September 9th, 1922. (203,663.)

20,668. "Adjusting devices for wireless telegraphic and telephonic instruments and the like." A. H. Chapman. August 14th, 1923. (223,010.)

21,561. "Electric time switches." W. E. King and Gas Meter Co., Ltd. August 25th, 1923. (223,018.)

22,262. "Inductance, reactance, and the like coils for wireless telegraphy or telephony, suitable also for use in variometers." S. Calamatianos. May 16th, 1923. (216,084.)

22,691. "Signalling systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). September 10th, 1923. (223,026.)

23,379. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, and F. Tench. September 18th, 1923. (223,030.)

24,819. "Automatic telephone systems and apparatus therefor." Western Electric Co., Ltd. (G. Deakin). October 5th, 1923. (223,040.)

25,138. "Electric tachometers." British Thomson-Houston Co., Ltd., A. F. Young and L. Griffiths. October 9th, 1923. (223,045.)

26,384. "Appliance for re-magnetising magnetos." F. Ball. October 23rd, 1923. (223,058.)

26,605. "Automobile headlamps and the like." N. C. Hall. October 24th, 1923. (223,061.)

26,614. "Wireless telegraph or telephone receiving apparatus." Mann, Egerton & Co., Ltd., and H. R. Taunton. October 24th, 1923. (223,061.)

28,288. "Dynamo-electric machines." English Electric Co., Ltd., and H. Barnes. November 9th, 1923. (223,064.)

28,302. "Electric engravers." British Thomson-Houston Co., Ltd. (General Electric Co.). November 9th, 1923. (223,065.)

31,663. "Means for tapping or collecting current from a bare electric conductor system." A. M. Willis and Brecknell, Munro & Rogers, Ltd. December 17th, 1923. (223,087.)

1924.

250. "Electrical terminal connection." A. M. M. Burn. January 4th, 1924. (223,093.)

2,045. "Headlights of automobiles and other vehicles." L. A. Stolpp. January 25th, 1924. (223,103.)

4,136. "Bonding clamps for metal-sheathed electric wires and cables." C. W. Bloomfield. February 18th, 1924. (223,117.)

4,154. "Sealing of leading-in conductors into evacuated quartz containers." Hewittic Electric Co., Ltd. February 22nd, 1923. (211,862.)

4,569. "Portative electric coupling devices." A. Mullor. February 22nd, 1923. (211,884.)

5,758. "Wireless aerials." F. R. R. J. Pearce. March 6th, 1924. (223,129.)

5,951. "Electrically-heated laying-out hand for gloves." Ward (Worcester), Ltd., and J. and G. Thomas. March 8th, 1924. (223,131.)

6,262. "Electric lamp-shade fittings." A. P. Turnbull and B. A. Giles. March 11th, 1924. (223,133.)

6,738. "Control arrangement for electric direct-current vehicles, with step-switch operated by servomotor." Maschinenfabrik Oerlikon and A. Laternser. November 23rd, 1923. (223,136.)

8,477. "Magneto-electric machines for massaging treatment." E. Thompson. April 3rd, 1924. (223,148.)

9,678. "Adapter for vacuum-tube sockets and the like." British Thomson-Houston Co., Ltd. June 5th, 1923. (217,188.)

9,799. "Electric motors." L. H. Burgy. April 21st, 1923. (214,643.)

10,311. "Malleable and ductile tungsten composition or alloy suitable for use in the manufacture of lighting bodies or filaments." British Thomson-Houston Co., Ltd. May 1st, 1923. (215,348.)

11,735. "Electric drop-light shade." H. P. Simmonds. May 12th, 1924. (223,164.)

14,370. "Radio receiving systems." Telefunken Ges. fur Drahtlose Telegraphie. June 13th, 1923. (217,601.)

17,165. "Methods of and means for neutralising capacity coupling between thermionic valve circuits." W. J. Mellersh-Jackson (Independent Radio Manufacturers, Inc.). April 5th, 1923. (Divided application on 222,895.) (223,181.)